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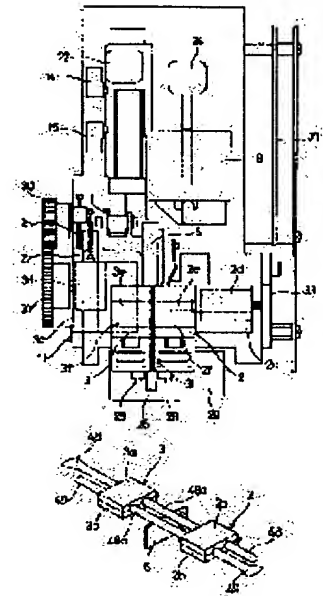
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## (54) ASEPTIC CONNECTION DEVICE FOR FLEXIBLE TUBE

## (57)Abstract:

**PURPOSE:** To conduct the connection of tubes surely by holding two flexible tubes by means of clamps, conducting cutting-off by moving a cutting-off means up and down between the clamps, moving a clamp in parallel so that cut-off end portions may be stuck closely to each other.

**CONSTITUTION:** In the case of an aseptic connection device for flexible tubes, at least two flexible tubes are held in a parallel state by means of clamps 2, 3, and flexible tubes 48, 49 are cut off between the clamps 2, 3 by means of a cutting-off device 5. At least one of the clamps 2, 3 is moved by means of a driving means so that the fellow end portions of the cut-off flexible tubes 48, 49 that are to be connected to each other may be stuck closely to each other, and the cutting-off means 5 is moved up and down between the clamps 2, 3 by means of a cutting-off means driving means. As for the clamps 2, 3, clamps that grasp the two flexible tubes 48, 49 as if to crush them, are used, and a second clamp movement mechanism possesses a push-pressing member 33 to push-press the second clamp 2 against the first clamp 3 side.



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**CLAIMS**

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[Claim(s)]

[Claim 1] It is equipment for joining a flexible tube in sterile. This equipment The 1st clamp and the 2nd clamp which hold at least two flexible tubes in the parallel condition, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, Flexible tube sterile junction equipment characterized by having a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp.

[Claim 2] It is equipment for joining a flexible tube in sterile. This equipment At least two flexible tubes in the parallel condition And the 1st clamp and the 2nd clamp which are grasped so that it may crush, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, It has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp. Said 2nd clamp migration device It has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping the 1st and 2nd clamps as two flexible tubes were crushed and a flexible tube is grasped, Sterile junction equipment characterized by being constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention carries out heating fusion of at least two flexible tubes, and relates to the flexible tube sterile junction equipment for connecting in sterile.

[0002]

[Description of the Prior Art] At the time of tube connection of the blood collecting bag in a transfusion system and a constituent-of-blood bag, and exchange of the dialysing fluid bag in continuous ambulatory PD (CAPD), and an effluent bag, it is necessary to connect a tube in sterile. As equipment which makes sterile connection of such a tube, it is shown in JP,61-30582,B and there is a thing. The equipment shown in this JP,61-30582,B is a tube contact which carries out heating fusion of the tube and is connected. And illustration of the example of conventional sterile junction equipment has the device as shown in drawing 19. The 1st clamp 111 and the 2nd clamp 110 which hold two flexible tubes 115,116 which should connect the junction equipment 100 shown in drawing 19 in the parallel condition, The cutting means 114 for cutting a flexible tube between the 1st clamp 111 and the 2nd clamp 110 (wafer), The migration means 113 to which the 1st clamp is moved so that both the edges to which the flexible tube cut by the cutting means is joined may face each other through a wafer, The cutting means 114 is moved up, melting cutting of the flexible tube is carried out, and it has the migration means 112 for moving the wafer after cutting caudad.

[0003] With this sterile junction equipment, and after heating the sheet metal-like wafer 114, It is made to move more nearly up than the lower part between the 1st clamp 111 and the 2nd clamp 110. After carrying out melting cutting of the flexible tube 115,116 between the 1st and 2nd clamps, After moving the 1st clamp 111 back so that both the edges to which the cut flexible tube is joined may stick (retreat), a wafer is moved caudad again, both the edges to which a flexible tube is joined are stuck, and it joins.

[0004]

[Problem(s) to be Solved by the Invention] And after a wafer 114 cuts a tube 115,116 between the 1st clamp 111 and the 2nd clamp 110 with above junction equipment, the 1st clamp (left-hand-side clamp) 111 retreats, the wafer 114 which moved to the location where the tube which should be joined faces mutually through a wafer 114, then was heated moves caudad, and the tube which should be joined will be in the condition face mutually. And the 1st clamp (left-hand side clamp) 111 moves to 110 the 2nd clamp side (right clamp side), it is stuck to the tube which should be joined, and both are joined. Therefore, the 2nd clamp (right clamp) 110 is in the condition always fixed to standing ways 118, and the 1st clamp 111 moves to the 2nd clamp side with a motion before and after retreating and moving forward, and it consists of this sterile junction equipment so that both of a motion of the longitudinal direction which returns again may be performed. That is, it is required to move one clamp in the opposite direction, although it is not simultaneous, such structure has a possibility of checking the exact movement toward a clamp, the movement toward a clamp might be made to produce distortion, and poor junction of the tube resulting from this distortion might be produced.

[0005] Then, the purpose of this invention can secure the exact movement toward a clamp, makes distortion of the movement toward a clamp fewer things, and offers the flexible tube sterile junction equipment which can ensure junction of a tube, without making both motion before and after canceling the trouble of the above-mentioned conventional technique and retreating and moving forward to the 1st clamp, and motion of a longitudinal direction which moves to the 2nd clamp side and returns again perform.

[0006]

[Means for Solving the Problem] It is equipment for joining a flexible tube in sterile which attains the above-mentioned purpose. This equipment The 1st clamp and the 2nd clamp which hold at least two flexible

tubes in the parallel condition, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, It is flexible tube sterile junction equipment which has the 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, and a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp.

[0007] It is equipment for joining a flexible tube in sterile which attains the above-mentioned purpose.

Moreover, this equipment At least two flexible tubes in the parallel condition And the 1st clamp and the 2nd clamp which are grasped so that it may crush, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, It has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp. Said 2nd clamp migration device It has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping the 1st and 2nd clamps as two flexible tubes were crushed and a flexible tube is grasped, It is sterile junction equipment constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp.

[0008] And as for said 1st clamp migration device, it is desirable to have the linear table for the 1st clamp which moves in parallel to said 2nd clamp. Furthermore, as for said 2nd clamp migration device, it is desirable to have the linear table for the 2nd clamp which moves to migration in the direction approached and estranged to said 1st clamp. .

[0009] Then, the flexible tube sterile junction equipment of this invention is explained with reference to a drawing. The 1st clamp 3 and the 2nd clamp 2 whose flexible tube sterile junction equipment 1 of this holds at least two flexible tubes 48 and 49 in the parallel condition, The cutting means 5 for cutting the flexible tubes 48 and 49 between the 1st clamp 3 and the 2nd clamp 2, The 1st clamp migration device to which the 1st clamp 3 is moved in parallel to the 2nd clamp 2 so that both the edges to which the flexible tubes 48 and 49 cut by the cutting means 5 are joined may face each other, It has the 2nd clamp migration device moved in the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3, and the cutting means driving means for moving the cutting means 5 up and down in two between the 1st clamp 3 and the 2nd clamp. This sterile junction equipment 1 furthermore, as the 1st and 2nd clamps 3 and 2 What grasps them as crushes two flexible tubes 48 and 49 is used. And the 2nd clamp migration device It has the press member 33 which presses the 2nd clamp 2 to the 1st clamp 3 side. And the press member 33 When the thrust of the press member 33 is weaker than the repulsive force of a flexible tube when grasping the 1st and 2nd clamps 3 and 2 as two flexible tubes were crushed and a flexible tube is grasped, It is constituted so that the 2nd clamp 2 may move in the direction estranged a little from the 1st clamp 3.

[0010] Drawing 1 is the perspective view of one example of the flexible tube sterile junction equipment of this invention. Drawing 2 is the perspective view showing the condition of having contained in the case the sterile junction equipment shown in drawing 1 , and drawing 3 is the block diagram showing an example of the electrical circuit used for the sterile junction equipment of this invention. Drawing 4 is the plan of one example of the flexible tube sterile junction equipment of this invention. In order to explain actuation of drawing 1 , drawing 2 R> 2, drawing 3 , drawing 4 , the 1st clamp, the 2nd clamp, and a cutting means for the sterile junction equipment 1 of this example, it explains using drawing 9 which is the perspective view of drawing 8 which is an explanatory view for explaining actuation of drawing 7 which is an explanatory view for explaining actuation of drawing 6 which is an explanatory view, and the 1st clamp, and a cutting means, the 1st clamp, and the 2nd clamp.

[0011] Next, the device of the sterile whole junction equipment 1 is explained. This sterile junction equipment 1 has the 1st clamp 3 and the 2nd clamp 2 which hold at least two flexible tubes in the parallel condition, as shown in drawing 1 , drawing 2 , drawing 4 , and drawing 9 . By rotation of the gear 30 rotated by actuation of a motor, the gear 31 rotated by rotation of a gear 30, and a gear 31 The arm 18 for a drive for moving the prevention member 11 for preventing shakiness by the home position of the frame 9 to which the both ends of the shaft 32 to rotate and a shaft were fixed pivotable, and the 1st clamp 3, microswitches 13, 14, and 15, and the 1st clamp 3, and the 1st clamp 3 Shakiness of the cam 17 for making the cam 19, the cutting means 5, the cutting means 5, and the 2nd clamp for making it move drive, the press member 33 which presses the 2nd clamp 2 to the 1st clamp side, the specification-part material 25 which regulates the retreat location of the 1st clamp 3, and the 1st clamp 3 The induction member 26 for guiding the spring

member 27 for preventing, the wafer exchange lever 22, the wafer cartridge 8, the wafer cartridge exchange lever 24, the used wafer housing grasping member 28, and a used wafer to a housing, the used wafer housing 29, and a control panel 50 It has.

[0012] As shown in drawing 3, moreover, the sterile junction equipment 1 of this example The source 43 for wafer heating of a constant voltage which has the rectification power circuit 41 which changes AC power supply into a direct current, and a predetermined electrical potential difference changes, The motor 42 by which a power source is similarly supplied from this source 43 of a constant voltage, and the controller 40 for controlling a motor 42 and the wafer heating control circuit 44, The wafer 6 for heating melting to cut a flexible tube and the temperature detection means 7 of this wafer 6, It has the wafer heating control means 44 which controls heating of a wafer 6 by controlling the power sent to a wafer 6 from the source 43 of a constant voltage based on the signal from the temperature detection means 7. Moreover, as shown in drawing 5, the connection terminal 9 for connecting the source 43 of a constant voltage and a wafer electrically is formed. And the reset switch 69 for returning equipment is electrically connected to the wafer heating control means 44 after actuation of a wafer short circuit, and the wafer heating control means 44 is electrically connected with the controller 40. Moreover, a microswitch SW1 (13), a microswitch SW2 (14), a microswitch SW3 (15), a microswitch SW4 (72), a microswitch SW5 (73), the microswitch SW6 (74), the electric power switch 51 prepared in the input panel 50, the initiation switch 52, and the clamp reset switch 53 are electrically connected to the controller 40, and the buzzer 45 which operates further with the signal outputted from a controller 40 is formed. A motor 42 is a driving source which makes the cutting means 5, the 1st clamp 3, and the 2nd clamp 2 drive.

[0013] And the 1st clamp migration device to which the 1st clamp 3 is moved so that both edges 48a from which this sterile junction equipment 1 was cut by the cutting means 5, and to which the flexible tubes 48 and 49 are joined, and 49a may face each other, It has the locomotive function for making a tubeside move the cutting means 5 (to upper part), and making it move in the direction (caudad) again separated from a tube after cutting, and the 2nd clamp migration device moved in the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3. It is what makes it move to a cutting means drive up perpendicularly to the shaft of two tubes, and moves the cutting means 5 to it caudad after tube cutting. The 1st clamp migration device It is what moves the 1st clamp 3 in the rectangular direction in the level condition to the shaft of two tubes (concrete -- back) after tube cutting. the 2nd clamp migration device The 2nd clamp 2 is moved in parallel very only in the level condition to the shaft of two tubes so that the 1st clamp side may be approached.

[0014] Then, the 1st and 2nd clamps 3 and 2 are explained. The 1st and 2nd clamps 3 and 2 are constituted as shown in drawing 1 R> 1, drawing 4, drawing 6, and drawing 9. Specifically, the 1st clamp 3 has base 3b, covering 3a attached in this base 3b pivotable, and clamp standing-ways 3c to which base 3b was fixed, as shown in drawing 9. And this clamp standing-ways 3c is being fixed to the linear table. The linear table is constituted by 3n of rail members prepared in the lower part of movable carriage 3c fixed to the inferior surface of tongue of clamp standing-ways 3c, and movable carriage 3c. And on this linear table, to the shaft of the tubes 48 and 49 to join, there is no distortion and the 1st clamp 3 is moved so that a perpendicular direction and both the edges to which in other words the cut flexible tube is joined may face each other. Therefore, the 1st clamp migration device is constituted from sterile junction equipment 1 of this example by the above-mentioned linear table, a motor, a gear 30, the gear 31, the shaft 32, the arm 18 for a drive, and the cam 19. And with this junction equipment 1, as shown in drawing 1 and drawing 4, the spring member 27 which connects the back of 1st clamp standing-ways 3c and the frame of junction equipment 1 is formed, the 1st clamp 3 is in the condition of always having been pulled back, and shakiness of the 1st clamp 3 (correctly 1st clamp standing-ways 3c) is made into few things. Moreover, as shown in drawing 1 R> 1 and drawing 4, the prevention member 11 for preventing shakiness of the 1st clamp 2 in the tube stowed position (location in the condition that in other words the 1st clamp came out to the foremost) of the 1st clamp 3 is being fixed to the side face of a frame 9. Therefore, the 1st clamp 3 is in the condition back pulled by the spring member 27, i.e., the condition which does not have shakiness in a back side, and shakes and can move [ at a tube stowed position ] no longer ahead from it by the prevention member in the front. Therefore, the 1st clamp 3 consists of tube stowed positions so that there may be no shakiness. Moreover, as shown in junction equipment 1 at drawing 1 and drawing 4, the specification-part material 25 which regulates the maximum migration location behind the 1st clamp 3 (correctly 1st clamp standing-ways 3c) is formed.

[0015] The 2nd clamp 2 has clamp standing-ways 2c by which covering 2a attached pivotable and base 2b were fixed to base 2b and this base 2b, as shown in drawing 4, drawing 6, and drawing 9. And this clamp

standing-ways 2c is being fixed to the linear table. The linear table is constituted by 2n of rail members prepared in the lower part of movable carriage 2c fixed to the inferior surface of tongue of clamp standing-ways 2c, and movable carriage 2c. And on this linear table, to the shaft of the tubes 48 and 49 to join, the 2nd clamp 2 does not have distortion only in an parallel direction and the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3, and, in other words, is moved to it.

[0016] Moreover, as shown in drawing 4 and drawing 6, the press member 33 is formed between the frame of junction equipment 1, and clamp standing-ways 2c, and the 2nd clamp 2 (correctly 2nd clamp standing-ways 2c) is always pushed on the 1st clamp side. As a press member, a spring member is used suitably. And what has the thrust of the press member 33 weaker than the repulsive force of a flexible tube when grasping the 1st and 2nd clamps 3 and 2 as two flexible tubes 48 and 49 were crushed is used, and when a flexible tube is grasped, this press member 33 is constituted so that the 2nd clamp 2 may move in the direction estranged a little from the 1st clamp 3. Therefore, the 2nd clamp migration device is constituted from sterile junction equipment 1 of this example by the above-mentioned linear table, a motor, a gear 30, the gear 31, the shaft 32, the cam 17, and the press member 33.

[0017] And as shown in drawing 9, the 1st clamp 3 and the 2nd clamp 2 are constituted so that the tube to hold may be held in the condition of having crushed aslant. Clamps 3 and 2 have the coverings 3a and 2a attached in base 3b and 2b possible [ revolution ], and in base 3b and 2b, in order to \*\*\*\* two tubes, they have two slots 3f and 3e established in parallel, and 2f and 2e. And the serrated knife-like lock out members 3h and 2h are formed in the end face of base 3b of the part which Slots 3f and 3e and Slots 2f and 2e face, and 2b. And the lock out members 3g and 2g of the shape of a serrated knife of the configuration corresponding to the lock out members 3h and 2h of the above-mentioned base 3b and 2b are formed in Coverings 3a and 2a. The internal surface of Coverings 3a and 2a is flat. And to Coverings 3a and 2a, it has the revolution cam, respectively, and this revolution cam will engage with the roller of base 3b and 2b, if Coverings 3a and 2a are closed. And when Coverings 3a and 2a are closed, two tubes are aslant crushed by between 3h of lock out members of base 3b, and 3g of lock out members of covering 3a, and between 2h of lock out members of base 2b, and 2g of lock out members of covering 2a, and are held in the condition of having blockaded. Moreover, since the 1st clamp 3 has lobe 3i which projects in the 2nd clamp direction and it has crevice 2i to which the 2nd clamp 2 contains this lobe 3i, the 2nd clamp 2 is constituted so that it cannot blockade, if the 1st clamp 1 is not blockaded.

[0018] Furthermore, the lock out members 2g and 2h of the 2nd clamp 2 have projected a little the tip of lock out member 2hf, and the tip of a part which faces 2hf(s) of 2g of lock out members although not illustrated from the tip of lock out member 2he to the 1st clamp side, as shown in drawing 18. For this reason, the distance X1 of a wafer 6 and lock out member 2hf is narrower than the distance X3 of a wafer 6 and lock out member 2he. Usually, with this sterile junction equipment 1, the tube 49 in use with which the liquid is filled up into the interior is equipped with and joined to the slots 2f and 3f of a near side. The slots 2e and 3e by the side of the back are equipped with the intact tube 48. Therefore, it will become short about the die length of tube 49 part which is located [ distance / X1 / of the wafer 6 which is the side equipped with a tube in use, and lock out member 2hf ] between a clamp 3 and 2 in a comparatively narrow thing and which is not grasping \*\*. Therefore, the liquid in the tube 49 located between clamps can be made into few things. Moreover, by making long distance X3 of the wafer 6 which is the side equipped with an intact tube, and lock out member 2he, the intact tube by which melting cutting was carried out with the wafer melts, it can carry out, \*\* can be made [ many ], and junction into the left-hand side part of the cut tube 49 in use becomes a more positive thing.

[0019] And two cams 19 and 17 are being fixed and sterile junction equipment 1 rotates cams 19 and 17 with rotation of a gear 31, as are shown in drawing 1, and it has the gear 30 rotated by the motor, and the gear 31 rotated by rotation of this gear 30 and is shown in the shaft 32 of a gear 31 at drawing 6. And cam-groove 19a for the 1st clamp drive of a configuration as shown in drawing 7 is prepared in the right lateral of a cam 19. And the arm 18 for the 1st clamp migration which has follower 18a which slides on the inside of cam-groove 19a of a cam 19 in the center section is formed. moreover, the lower limit of an arm 18 is supported by the frame 9 rotatable by supporting-point 18b, and the upper limit of an arm 18 is boiled by supporting-point 18c prepared in clamp standing-ways 3c of the 1st clamp 3, and is supported rotatable. Therefore, along with 3n of rail members of a linear table, as shown in drawing 7, the 1st clamp 3 moves to the rectangular direction back in the level condition to the shaft of two tubes by rotation of a cam 19, as shown in an arrow head according to the configuration of cam-groove 19a.

[0020] The cutting means 5 has wafer attaching part 5a which holds a wafer exchangeable, arm section 5c in which wafer attaching part 5a was prepared caudad, follower 5b prepared in the edge of arm section 5c, and

5d of hinge regions and attachment section 5e to a frame 9, as shown in drawing 5 . And it can circle to a frame 9 by 5d of hinge regions. And as shown in drawing 5 , the temperature detection means 7 for temperature detection of the electrical connection terminal 9 for wafer heating and a wafer is being fixed to the right lateral of the cutting means 5. As a temperature detection means 7, it is desirable that they are a thermocouple or a resistance bulb. \*\* which is a sheath form thermocouple or a resistance bulb, especially a sheath form thermocouple are desirable more preferably. What has the metal plate bent as a wafer 6 so that it might face each other, the insulating layer formed in the inside of this metal plate, the resistor formed so that the above-mentioned metal plate might not be contacted in this insulating layer, and the terminal for energization prepared in the both ends of this resistor is used suitably.

[0021] And the cam 17 has cam-groove 17a for a cutting means drive in the left lateral, as shown in drawing 5 and drawing 8 . And follower 5b of the cutting means 5 is located in cam-groove 17a of a cam 17, and slides on the inside of cam-groove 17a in accordance with the configuration of a cam groove. Therefore, by rotation of a cam 17, as shown in drawing 8 , the cutting means 5 will move to a rectangular cross and the perpendicular direction upper and lower sides to the shaft of two tubes, if it puts in another way up and down according to the configuration of cam-groove 17a. Furthermore, the cam 17 has cam-groove 17c for the drive of the 2nd clamp 2 in the center section, as shown in drawing 6 . Cam-groove 17c has 17f of left laterals, and right lateral 17e, and controls the location of the 2nd clamp by 17f of left laterals, and right lateral 17e. In 2nd clamp standing-ways 2c, it has the lobe extended caudad, and the follower 20 is formed at the tip. This follower 20 slides on the inside of cam-groove 17c for the drive of the 2nd clamp 2. And between the side faces of a follower 20 and cam-groove 17c, as shown in drawing 6 , it is formed so that the clearance between some may be made. And since 2nd clamp standing-ways 2c is always pushed by the spring member 33, in a normal state, a follower 20 comes to contact 17f of left laterals of cam-groove 17c, and the clearance between some is made between a follower 20 and right lateral 17e of cam-groove 17c. However, as mentioned above, if two tubes are held by the 1st and 2nd clamps 3 and 2, since it blockades and two clamps 3 and 2 hold, respectively so that two tubes may be crushed, they will arise [ the repulsive force resulting from lock out of a tube ]. And in the condition that clamps 3 and 2 hold a tube, since the thing of the force smaller than the repulsive force resulting from lock out of the above-mentioned tube is used, as shown in drawing 6 , a follower 20 comes to contact right lateral 17e of cam-groove 17c, and the clearance between some is made by the spring member 33 between a follower 20 and 17f of left laterals of cam-groove 17c. However, since the repulsive force to which a tube originates in cutting \*\*\*\* and lock out of a tube with the above-mentioned cutting means 5 disappears, return and a follower 20 come to contact 17f of left laterals of cam-groove 17c, and the clearance between some is made in a normal state between a follower 20 and right lateral 17e of cam-groove 17c. Thus, it is constituted so that the sliding surface of the cam groove which a follower 20 contacts may change with an operation of the spring member 33 and the repulsive force of a tube with time.

[0022] And as shown in drawing 6 , 17d of crevices is formed in 17f of left laterals. Since the stage when a follower 20 passes 17d part of this crevice is after cutting of a tube by the cutting means, a follower 20 is in the condition which meets and is sliding on 17f of left laterals of a cam groove 17, and, therefore, a follower 20 goes into crevice 17 part. For this reason, the 2nd clamp 2 will move in the 1st clamp 3 direction by the depth of 17d of crevices. Thereby, junction of a tube becomes more certain. And 17g of crevices is established also in right lateral 17e of cam-groove 17c. 17g of this crevice is a thing for cleaning of the inside of clamps 3 and 2. The 2nd clamp 2 can be moved in the direction estranged from the 1st clamp 3, and, thereby, a clearance is formed between the 1st clamp 3 and the 2nd clamp until a follower 20 contacts 17g of crevices by pushing the 2nd clamp 2 on the spring member 33 side by preparing 17g of this crevice. It becomes possible to clean with the cotton swab containing the solvent which can dissolve the formation ingredient of tubes cut to some extent, such as a cleaning member, for example, alcohol etc., into the formed gap. 17g of this crevice is established in the location which faces mostly 17d (part into which \*\*\*\*\* of the 2nd clamp 2 is performed) of crevices of 17f of left laterals, as shown in drawing 6 . When the follower 20 formed in the lobe to which 2nd clamp standing-ways 2c is extended caudad is contained in 17d part of crevices, it is in the condition which joined both the tubes made into the purpose after tube cutting, and the 2nd clamp stops in this condition. Moreover, the 1st clamp is also already stopped and the 1st clamp 3 is in the location which shifted from the 2nd clamp. As shown in drawing 1 , the 1st clamp 3 is retreating from the 2nd clamp 2, and, specifically, the 1st clamp 3 has it in the location which shifted from the 2nd clamp. For this reason, in this condition, the inside of the point of the 2nd clamp 2 is exposed a little, and has also exposed the inside of the back end section of the 1st clamp a little further. Therefore, the cleaning is easy for the inside of the 2nd clamp 2 and the 1st clamp 3 which were exposed.



[0023] Next, an operation of the sterile junction equipment 1 of this invention is explained using a drawing. Drawing 10 is a timing chart which shows actuation of a cutting means, the 1st clamp, and the 2nd clamp. Drawing 11, drawing 12, and drawing 13 are the flow charts for explaining an operation of sterile junction equipment. Drawing 14 R> 4, drawing 15, drawing 16, and drawing 17 are the explanatory views for explaining an operation of sterile junction equipment. Drawing 18 is an explanatory view for explaining the movement toward the 1st and 2nd clamps of sterile junction equipment 1, and the grasping condition of a tube. With this junction equipment 1, the 1st clamp 3 at the time of junction activity termination serves as a location which shifted from the 2nd clamp 2, and is in the halt location of the timing chart of drawing 10. The include angle of the axis of abscissa of the timing chart of drawing 10 makes 0 degree a zero (condition whose location of the 1st clamp and the 2nd clamp suits), and, in other words, are angle of rotation of the shaft 32 of the subsequent gear 31, and a thing which shows the movement toward the cutting means at the time of angle of rotation of a cam 17 and a cam 19 (wafer), the 1st clamp 3, and the 2nd clamp 2.

[0024] First, as first shown in drawing 11 of a flow chart, the electric power switch 51 prepared in the panel 50 of drawing 3 is pushed. By CPU which constitutes by this the controller 40 shown in drawing 3, when it judges whether it is normal (isn't there any omission of an internal connector, or isn't there specifically any open circuit of a thermocouple, or isn't there any defect in the source of an internal constant voltage?) and there is the above, a buzzer carries out singing of the junction equipment 1. Then, the clamp reset switch 53 prepared in the panel 50 of drawing 3 R> 3 is pushed. By CPU, it judges whether the 1st and 2nd clamps are open, whether there are any 1st and 2nd clamps in a zero, and whether a wafer exchange lever is in a zero. In addition, since the clamp used with the sterile junction equipment 1 of this example has lobe 3i to which the 1st clamp 3 projects in the 2nd clamp direction as mentioned above and it has crevice 2i to which the 2nd clamp 2 contains this lobe 3i, the 2nd clamp 2 is constituted so that it cannot blockade, if the 1st clamp 1 is not blockaded. For this reason, it is detected by the microswitch 13 with which ON/OFF of the 1st and 2nd clamps being open is carried out by the lever 16 which contacts, and this lever 16 when the 2nd clamp is blockaded. When OFF, a \*\*\*\* cage, and the 2nd clamp 2 are blockaded, a lever 16 is contacted, a lever 16 moves, and, specifically, a microswitch 13 makes a microswitch 13 ON condition, when the 2nd clamp is in a release condition. The ON/OFF signal of this microswitch 13 is inputted into a controller 40. It is judged that there are no 1st and 2nd clamps in a zero when a microswitch SW5 (73) and SW6 (74) detect the slot prepared on the periphery of each cam. It is detected by the microswitch 14 that the wafer exchange lever 22 is in a zero. When a microswitch 14 serves as ON when a lever 22 is in a zero, and there is nothing at a zero, OFF comes and the ON/OFF signal of this microswitch 14 is inputted into a controller 40.

[0025] And as shown in drawing 11, when all four above-mentioned points are YES(s), a motor is operated and the 1st and 2nd clamps are returned to a zero. Moreover, an abnormality lamp puts out the light by in No, BUSA's carrying out singing, and an abnormality lamp's lighting up, performing manual discharge, and pushing at least one reset switch among four above-mentioned points. After the 1st and 2nd clamps arrive at a zero, the 1st and 2nd clamps are equipped with two flexible tubes 48 and 49. The 1st and 2nd clamps 3 and 2 in this condition are in the condition that 2f faced mutually slot 3e which is in the condition which both opened wide, and was prepared for both, and 2e and 3f, as [ show / in drawing 9 ]. And the slots 3f and 2f of a near side are equipped with the tube 49 in use, and the slots 3e and 2e by the side of the back are equipped with the intact tube 48 connected.

[0026] And after blockading the 1st and 2nd clamps 3 as mentioned above, the wafer exchange lever 22 is pushed on a clamp side, and wafers are exchanged. By pushing the wafer exchange lever 22 on a clamp side, a wafer newer than the inside of the wafer cartridge 8 is taken out, and while push and a standby wafer are equipped with the used wafer with which push and a standby wafer were equipped with the standby wafer with which the cutting means 5 is equipped with a new wafer by the cutting means 5 in an operating location, a used wafer is contained in the used wafer housing 29. By then, CPU which constitutes the controller 40 which will shift to \*\* of the flow chart of drawing 12 if the initiation switch 52 of a panel 50 is pushed, and is shown in drawing 3 [ whether the 1st and 2nd clamps have closed, whether a wafer is exchange settled, and ] Whether the 1st and 2nd clamps are in a zero, whether a wafer exchange lever is in a zero, and whether the 1st and 2nd clamps have closed When the 2nd clamp is blockaded, it is detected by the lever 16 which contacts, and the microswitch 13 in which ON/OFF is carried out by this lever 16. When the 2nd clamp is in a release condition, OFF has come, when the 2nd clamp 2 is blockaded, a lever 16 is contacted, a lever 16 moves, and, specifically, a microswitch 13 makes a microswitch 13 ON condition. The ON/OFF signal of this microswitch 13 is inputted into a controller 40. If whether a wafer is exchange settled does push and a wafer exchange activity in the clamp direction for the wafer exchange lever 22, since the exchange lever 22 makes a microswitch 15 turn on once, it will be detected whether it was exchanged by



ON signal from a microswitch 15. The ON/OFF signal of a microswitch 15 is inputted into a controller 40. Whether the 1st and 2nd clamps are in a zero detects with microswitches 5 and 6 as mentioned above. [0027] And as shown in drawing 12, in No, BUSA carries out singing and returns to \*\* of drawing 11 at least one of the four above-mentioned points. Moreover, when all the four above-mentioned points are YES (s), the working lamp 47 lights up and heating of a wafer is started. it judges whether a wafer current is beyond the set point after heating initiation of a wafer, and a wafer short-circuits this -- \*\*\*\* -- it is for judging. And when a wafer current is not below the set point (the electrical potential difference concerning shunt resistance beyond a predetermined value), after waiting for 0.3 seconds, it judges whether a wafer current is set point within the limits. When a wafer is a used thing, since resistance falls for the heat history of a resistor, this measures a wafer current, detects whether it is in a setting range (inside of tolerance) as compared with the wafer current set up beforehand, and, thereby, judges electrically whether a wafer is used. After BUSA carries out singing, suspending heating of a wafer, and the abnormality lamp in a wafer lighting up and pushing a reset switch when the above-mentioned wafer current is beyond the set point, and when an above-mentioned wafer current is not in a setting range (when the wafer has short-circuited) (when a wafer is used), it shifts to flow chart \*\* of drawing 11. And heating of a wafer is continued when it is in a setting range (inside of tolerance) as compared with a wafer current. Heating of a wafer 6 is performed controlling the source 43 of a constant voltage by the Pulse-Density-Modulation signal computed based on the temperature detection output of the thermocouple 7 which is a wafer temperature detection means. and in order to prevent superfluous heating of a wafer, when it judges whether the heating time of a wafer is predetermined within a time, and it judges whether a wafer current is below a predetermined value and the wafer has caused short circuit accident below the predetermined value that is, immediately, BUSA carries out singing, suspends heating of a wafer, and shifts to flow chart \*\* of drawing 11. And if the temperature of a wafer reaches laying temperature, it shifts to flow chart \*\* of drawing 13, and a motor operates, thereby, a gear 30, a gear 31, and cams 19 and 17 will rotate, a cutting means (wafer) will go up, and \*\*\*\*\* by the side of cutting of a tube, retreat of the 1st clamp, descent of a cutting means (wafer), and the 1st clamp of the 2nd clamp will be performed.

[0028] And as shown in the flow chart of drawing 13, a rise of a wafer, cutting of a tube, retreat of the 1st clamp, and descent of a wafer are performed in each sequence. If it explains concretely, when a cam 17 rotates in the direction of an arrow head, follower 5b of the cutting means 5 will slide the inside of cam-groove 17a first. From the condition that the zero O of a cam groove shown in drawing 8 and drawing 10 at the beginning touched follower 5b, the point A of cam-groove 17a shown in drawing 8 and drawing 10 comes to contact follower 5b. And as shown in drawing 10, gently-sloping, the cutting means 5 goes up and two flexible tubes are cut from the condition that the point A of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b in the meantime, until the point B of cam-groove 17a results in the condition of contacting follower 5b. If it explains using drawing 14 and drawing 15, two tubes 48 and 49 are held by the 1st clamp 3 and the 2nd clamp 2, the tube parts 48a and 49a located between the 1st clamp 3 and the 2nd clamp 2 are formed, and the wafer 6 of a cutting means is located in the lower part. And as mentioned above, by rotation of a cam 17, when the cutting means 5 (wafer 6) goes up, as shown in drawing 15, melting cutting of both is carried out in the tube parts 48a and 49a located between the 1st clamp 3 of two tubes, and the 2nd clamp 2.

[0029] And as shown in drawing 8 and drawing 10, the condition that the cutting means 5 went up is maintained, and the edge from which Tubes 48a and 49a were cut is fully dissolved, until it results in the condition that the point C of cam-groove 17a contacts follower 5b from the condition that the point B of cam-groove 17a shown in drawing 8 contacts follower 5b. And as shown in drawing 8 and drawing 10, the cutting means 5 descends gently-sloping, until the point E of cam-groove 17a results [ from the condition that the point C of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b ] in the condition of contacting follower 5b. Moreover, as shown in drawing 7, when a cam 19 rotates in the direction of an arrow head, follower 18a prepared in the arm 18 for moving the 1st clamp slides the inside of cam-groove 19a. From the condition that the zero O of a cam groove shown in drawing 7 and drawing 10 at the beginning touched follower 18a, the point F of cam-groove 19a shown in drawing 7 and drawing 10 comes to contact follower 18a. As shown in the timing chart of drawing 10, follower 18a results in cam-groove 19a a point F early a little rather than follower 5b of the cutting means 5 results in the point B of cam-groove 17a. And as shown in drawing 10, gradually, the 1st clamp 3 retreats, will be in the condition which shows in drawing 16 R> 6, and will be in the condition that the tube parts 49a and 48a joined faced each other through the wafer 6, until the point G of cam-groove 19a results [ from the condition that the point F of cam-groove 19a contacts follower 18a ] in the condition of contacting follower 18a, as shown in drawing

7 R> 7 and drawing 10 . As shown in the timing chart of drawing 10 , this condition is maintained from the condition that the point G of cam-groove 19a contacts follower 18a until the point C of cam-groove 17a results in the condition of contacting follower 5b. And the condition of drawing 16 is maintained until the location of the 1st clamp results [ from the condition that Point G contacts follower 18a ] in the condition that the point H of cam-groove 19a contacts follower 18a. In addition, as the cutting means 5 is shown in drawing 8 and drawing 10 until the point E of cam-groove 17a results [ from the condition that the point C of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b as mentioned above ] in the condition of contacting follower 5b, it descends gently-sloping and the tube parts 48a and 49a joined contact.

[0030] And with the time of resulting in the condition which descent of the cutting means 5 ended, and the condition that the point E of cam-groove 17a contacts follower 5b, mostly, as shown in drawing 6 and drawing 10 , in other words, the 2nd clamp 2 performs \*\*\*\*\* to coincidence at the 1st clamp side. As shown in drawing 6 and drawing 10 , specifically the point M of 17d of left laterals of cam-groove 17c Gradually until the point L of a left lateral results [ from the condition of contacting the follower 20 for making the 2nd clamp 2 driving ] in the condition of contacting a follower 20 the 2nd clamp 2 It moves to the 1st clamp 3 side, and the condition of having \*\*\*\*\* (ed) is maintained until the point K of 17d of crevices results [ from the condition that the point LK of 17d of crevices of cam-groove 17c contacts a follower 20 ] in the condition of contacting a follower 20. By this \*\*\*\*\* , since both of the tube parts 48a and 49a stick certainly, they can make both junction a more positive thing. And gradually, the 2nd clamp 2 moves in the direction separated from the 1st clamp 3 side, and actuation of a motor stops it to this \*\*\*\*\* until the point J of 17f of left laterals results [ from the condition that the point K of 17d of crevices of cam-groove 17c contacts a follower 20 ] in the condition of contacting a follower 20.

[0031] Therefore, the 1st clamp 3 in the stopped location serves as location shifted like drawing 16 , as the location of the 2nd clamp 2 is shown in drawing 17 . And if wafer temperature is detected by the thermocouple and wafer temperature becomes below the set point as shown in the flow chart of drawing 13 R> 3, a run light will put out the light and BUSA will carry out singing. And as shown in drawing 17 , the junction activity of a tube is completed by opening the 1st clamp 2 and the 2nd clamp 3, and taking out a tube.

[0032] The 1st clamp and the 2nd clamp consist of conventional sterile junction equipment so that they may be grasped, as two tubes are crushed. And as shown in (A-1) of drawing 18 , the front part of the 1st clamp 3 is estranged distance X2 with the wafer 6, and the 2nd clamp 2 is estranged distance X1 with the wafer 6. In the condition that both of the 1st and 2nd clamps 3 and 2 were fixed completely, as shown in (A-2) of drawing 18 , the part during the 1st and 2nd clamps of two crushed tubes will be in the condition of having swollen, will be performed behind, and will cause trouble to junction of a \*\*\*\* tube. For this reason, since the 2nd clamp 2 (right clamp) is being fixed, it is pushed on the repulsive force of a tube when grasping the 1st clamp 3 (left clamp), as two tubes were crushed, and as shown in (A-2) of drawing 18 , it consists of conventional junction equipment so that the 1st clamp may move in the direction separated from the 2nd clamp a little. Thereby, distance (X2+\*\*x) alienation of the 1st clamp 3 is carried out with a wafer 6. Moreover, after the repulsive force of a tube disappears (i.e., after a tube is cut by the wafer), as shown in (A-3) of drawing 18 , the spring which presses the 1st clamp to the 2nd clamp side is prepared so that it may move in the direction which approaches the 2nd clamp side again.

[0033] Moreover, with this kind of junction equipment, it equips with the tube 49 in use with which the liquid was filled up into the slit of the near side of a clamp, the slit by the side of the back of a clamp is equipped with the intact tube 48 for connection, and both are joined. However, with conventional junction equipment, as shown in (A-2) of drawing 13 , in order that the 1st clamp 3 may move to left-hand side by having grasped tubes 48 and 49, a wafer 6 will be inserted between the 1st clamp 3 and the 1st clamp 2, and the right-hand side of the part which swelled a little will be cut. When the liquid exists in the interior of the part which swelled a little in many cases and the right-hand side is cut, as it is inserted between the 1st clamp 3 of a tube, and the 1st clamp 2 during use, and it is shown in (A-3) of drawing 13 , the liquid which existed may remain in a wafer front face, it may originate in this, and poor junction of a tube may arise. However, with the sterile junction equipment 1 of this invention, the end face by the side of the 1st clamp of the tube joined can be made into a more beautiful end face, and junction of a tube can be ensured.

[0034] As by carrying out melting cutting of the tube with the wafer with which the 1st clamp which moved in the direction separated from the 2nd clamp according to the repulsive force by grasping a tube as the sterile junction equipment of the former shows to (A-2) of drawing 18 , when it explains concretely was heated shows to (A-3) of drawing 18 R> 8, it moves to the 2nd clamp side again. Therefore, in the phase (A-

3) of drawing 18, the tube ingredient and contents for die length equivalent to the migration length (\*\*x) by the side of the 2nd clamp of the 1st clamp will fuse and adhere to a wafer front face (the 2nd clamp side front face of a wafer). And as shown in (A-4) of drawing 18, the 1st clamp is back moved for junction of a tube. The end face by the side of the 1st clamp of the tube joined in order to move so that the melting resin and contents adhering to a wafer front face may be dragged at this time cannot turn into a beautiful end face easily, may originate in this, a wafer may move caudad, and poor tube junction may be produced in a part for the joint of the tube formed after being stuck to both the tubes joined.

[0035] Like conventional junction equipment, the 1st clamp and the 2nd clamp are constituted by the sterile junction equipment 1 of this invention so that they may be grasped, as two tubes are crushed. And as shown in (B-1) of drawing 18, the front part of the 1st clamp 3 is estranged distance X1 with the wafer 6, and the 2nd clamp 2 is estranged distance X2 with the wafer 6. And as shown in (B-2) on the left-hand side of drawing 18, it is pushed on the repulsive force of a tube when grasping the 1st clamp 3 (left clamp), as two tubes were crushed, and it is constituted so that the 2nd clamp may move in the direction separated from the 1st clamp a little, and, thereby, distance (X1+\*\*x) alienation of the 2nd clamp 2 is carried out with a wafer 6. Moreover, after the repulsive force of a tube disappears (i.e., after a tube is cut by the wafer), as shown in (B-3) of drawing 18, the 2nd clamp 2 is pushed by the spring member 23, and moves in the direction which approaches the 1st clamp 3 side again.

[0036] Therefore, with the junction equipment 1 of this invention, in order that the 2nd clamp may move to right-hand side when clamps 3 and 2 grasped tubes 48 and 49 as shown in (B-2) of drawing 13, a wafer 6 will be inserted between the 1st clamp 3 and the 1st clamp 2, and the left-hand side of the part which swelled a little will be cut. It is inserted between the 1st clamp 3 of a tube 49, and the 1st clamp 2 during use, and the liquid exists in the interior of the part which swelled a little in many cases. However, since left-hand side is cut, poor junction of the tube resulting from the liquid which the liquid which existed did not remain in a wafer front face, and remained in the wafer front face can be prevented.

[0037] Furthermore, with the junction equipment 1 of this invention, by carrying out melting cutting of the tube with the heated wafer, the 2nd clamp 2 moves the 2nd clamp to the 1st clamp side again, as shown in (B-3) of drawing 18. Therefore, in the phase (B-3) of drawing 18, the tube ingredient for the die length equivalent to the migration length (\*\*x) by the side of the 1st clamp of the 2nd clamp will fuse and adhere to a wafer front face (the 2nd clamp side front face of a wafer). And as shown in (B-4) of drawing 18, the 1st clamp is back moved for junction of a tube. Since there is little adhesion of the resin and contents which were fused in the 1st clamp side front face of a wafer compared with the 2nd clamp side front face at this time, it is rare to move so that the melting resin and contents adhering to a wafer front face may be dragged, and the end face by the side of the 1st clamp of the tube joined can consider as a beautiful thing. Moreover, on the 2nd clamp side front face of a wafer adhering [ many ], since migration of a tube is not performed, the end face by the side of the 2nd clamp of the tube joined can also make melting resin beautiful.

Therefore, it is rare to produce poor tube junction in a part for the joint of the tube formed after being stuck to both the tubes joined.

[0038]

[Effect of the Invention] The sterile junction equipment of this invention is equipment for joining a flexible tube in sterile. This equipment The 1st clamp and the 2nd clamp which hold at least two flexible tubes in the parallel condition, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, Since it has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp, the 1st clamp Since only the motion before and after retreat and advance performs only the motion which approaches the 1st clamp side and is estranged, it can secure the exact movement toward each clamp, can make distortion of the movement toward a clamp fewer things, and, as for a deed and the 2nd clamp, can ensure junction of a tube.

[0039] Moreover, the flexible tube sterile junction equipment of this invention It is equipment for joining a flexible tube in sterile. This equipment At least two flexible tubes in the parallel condition And the 1st clamp and the 2nd clamp which are grasped so that it may crush, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, It has a cutting means driving means for moving

said cutting means up and down between said 1st clamp and the 2nd clamp. Said 2nd clamp migration device It has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping the 1st and 2nd clamps as two flexible tubes were crushed and a flexible tube is grasped, Since it is constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp, as mentioned above the 1st clamp Since only the motion before and after retreat and advance performs only the motion which approaches the 1st clamp side and is estranged, it can secure the exact movement toward each clamp, can make distortion of the movement toward a clamp fewer things, and, as for a deed and the 2nd clamp, can ensure junction of a tube. With the junction equipment of this invention, it is back moved for junction of a tube. Furthermore, in the front face (wafer front face by the side of the 1st clamp) of a near wafer Since there is little adhesion of the resin and contents which were fused compared with the wafer front face (wafer front face by the side of the 2nd clamp) of the opposite side It is rare to move so that the melting resin and contents adhering to a wafer front face may be dragged. It is rare to produce poor tube junction in a part for the joint of the tube formed after being stuck to both the tubes to which the end face by the side of the 1st clamp of the tube joined can consider as a beautiful thing, and is joined.

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[Translation done.]

**\* NOTICES \***

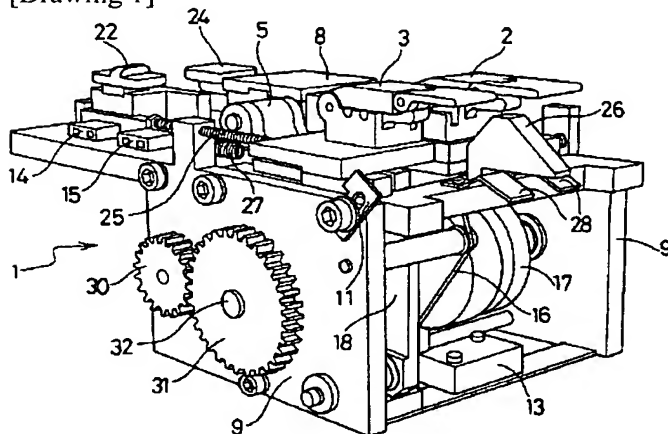
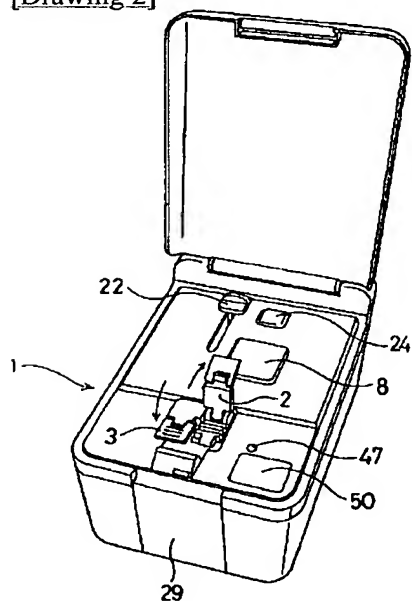
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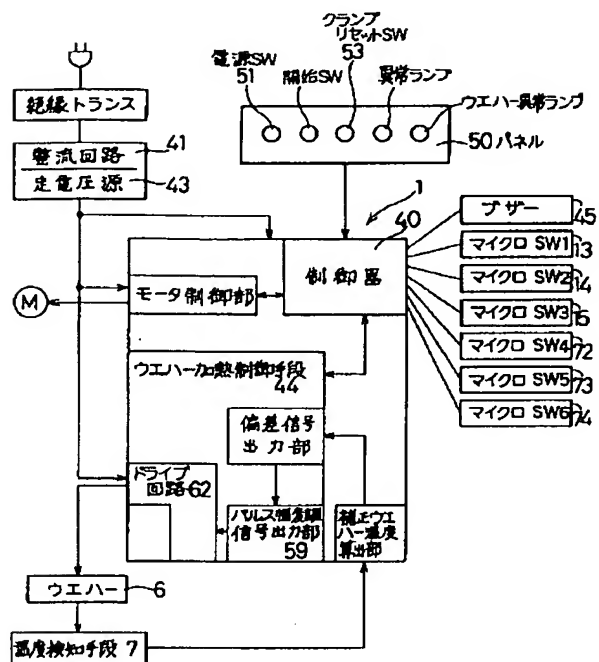
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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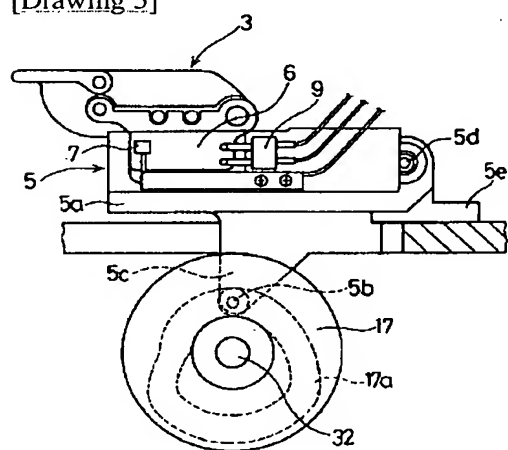
**DRAWINGS**

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**[Drawing 1]****[Drawing 2]****[Drawing 3]**

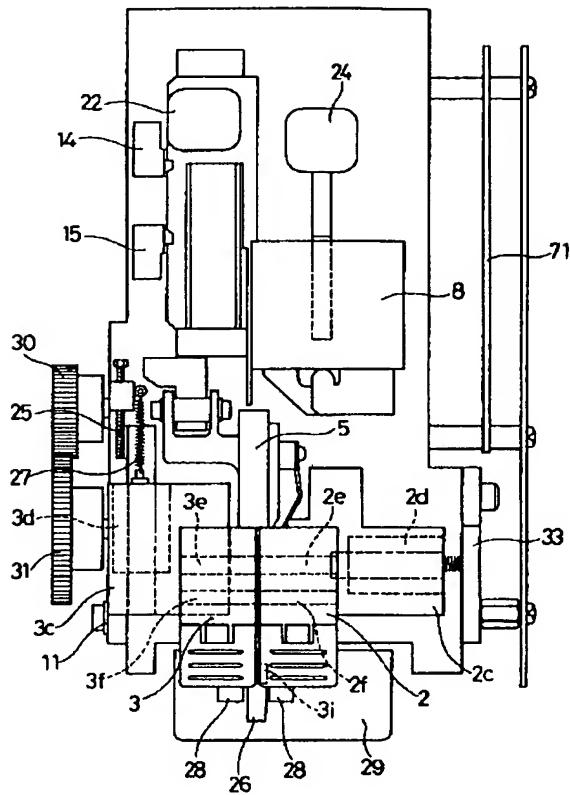


[Drawing 5]

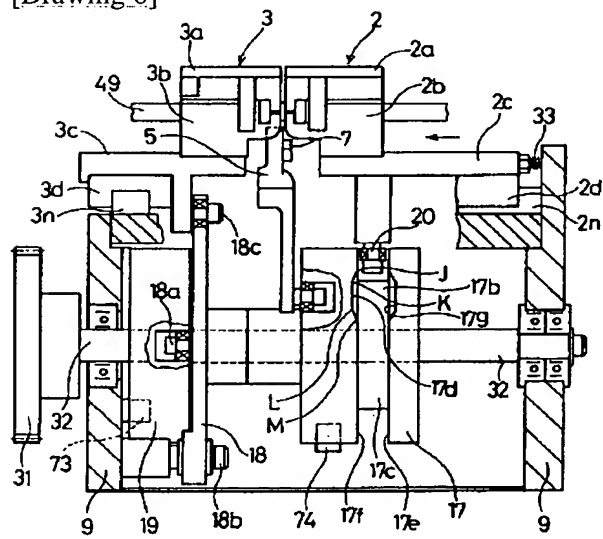


[Drawing 4]

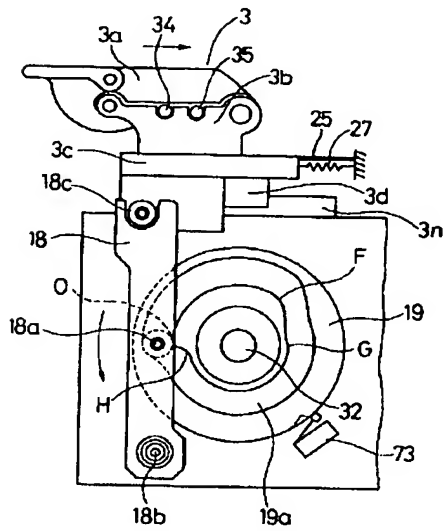




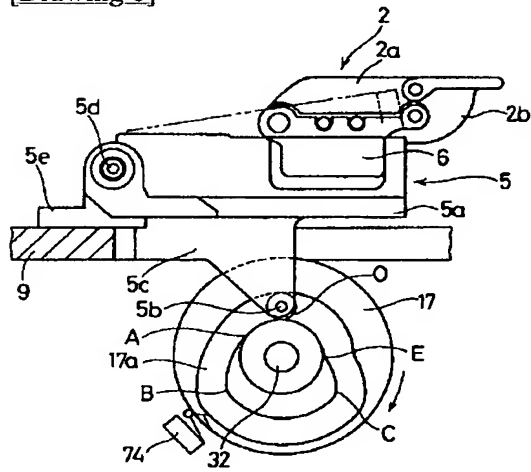
[Drawing 6]



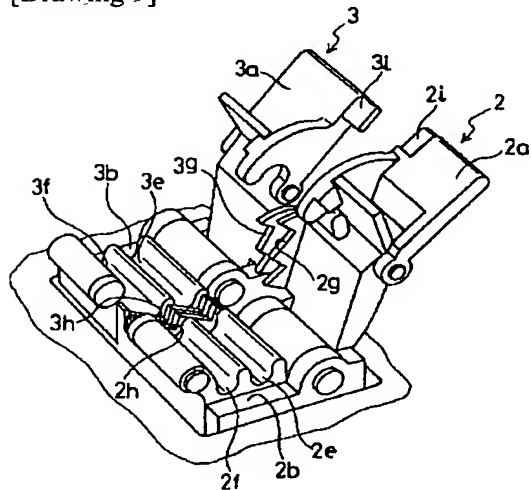
[Drawing 7]



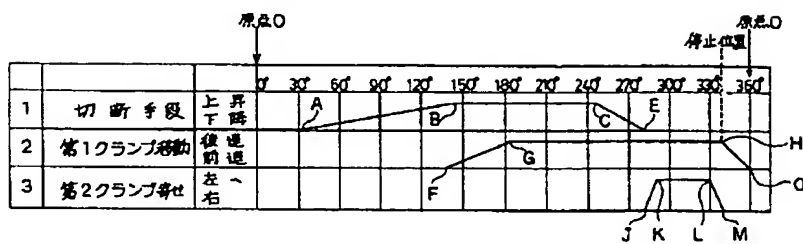
[Drawing 8]



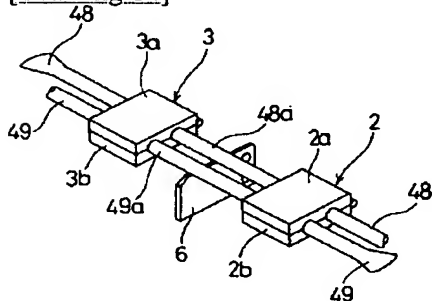
[Drawing 9]



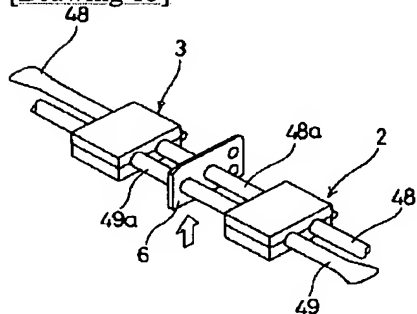
[Drawing 10]



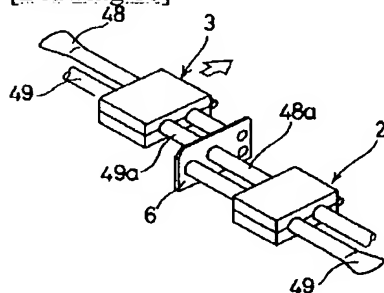
[Drawing 14]



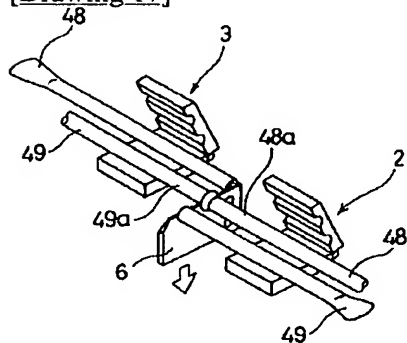
[Drawing 15]



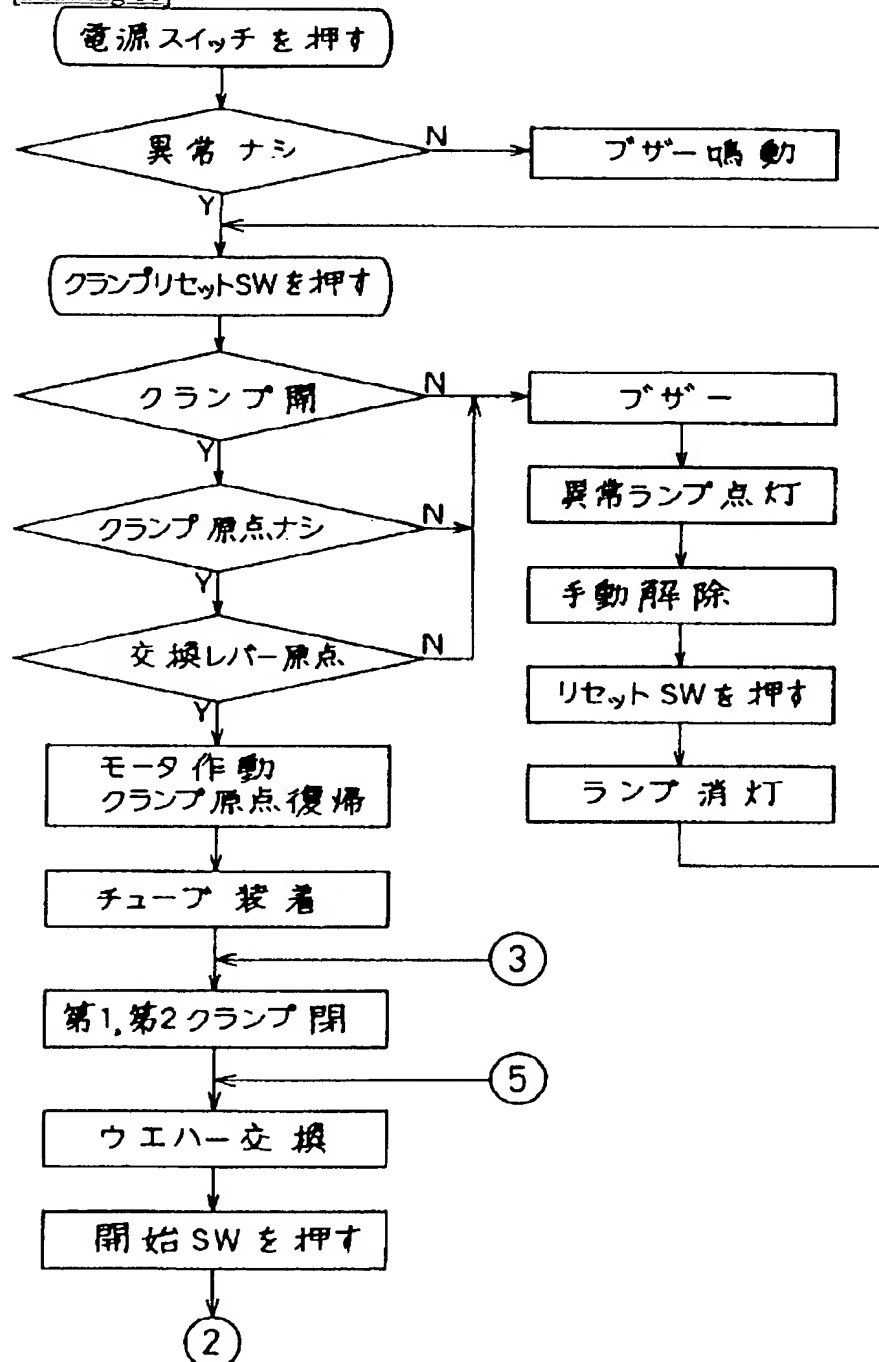
[Drawing 16]



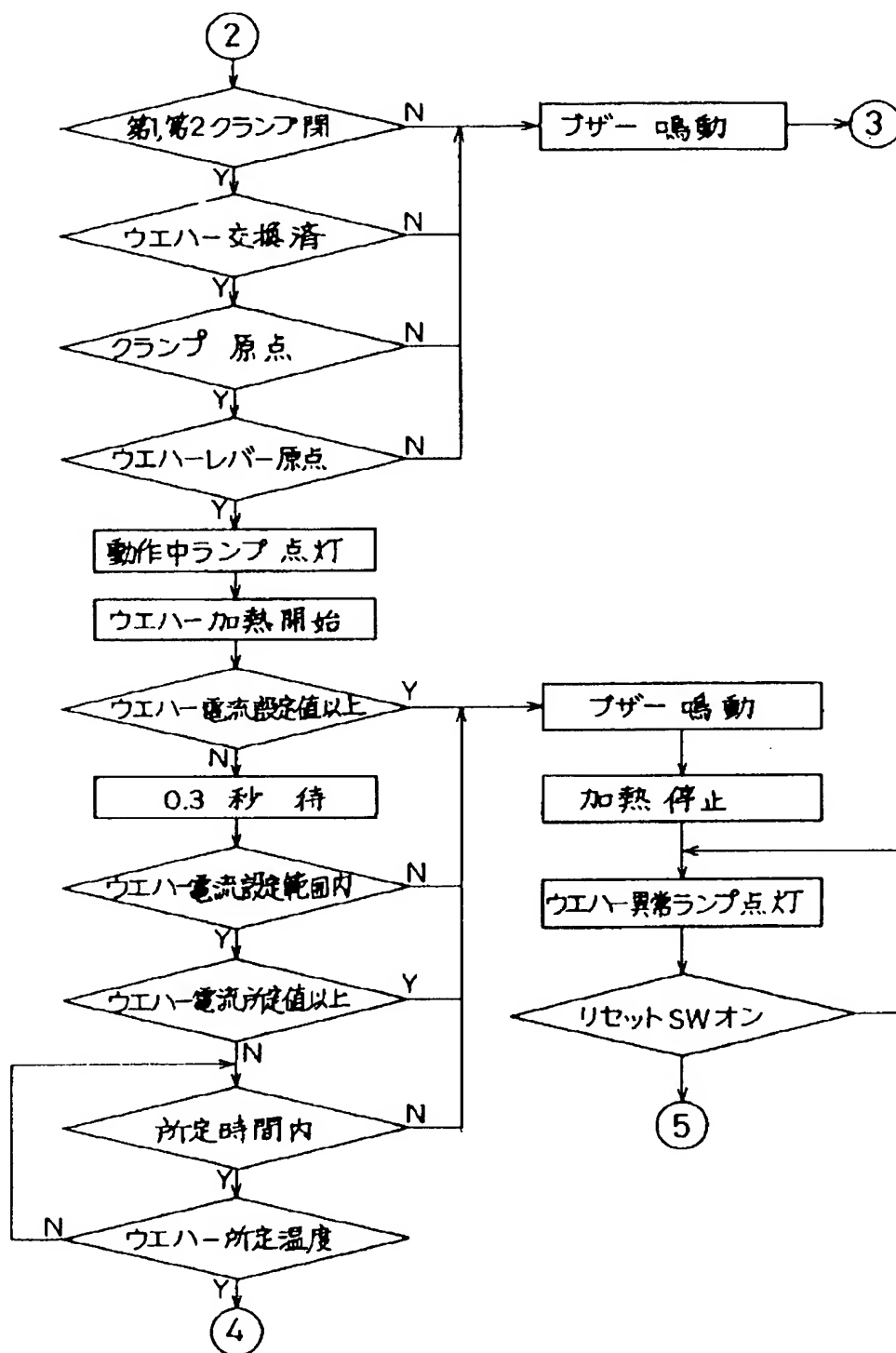
[Drawing 17]



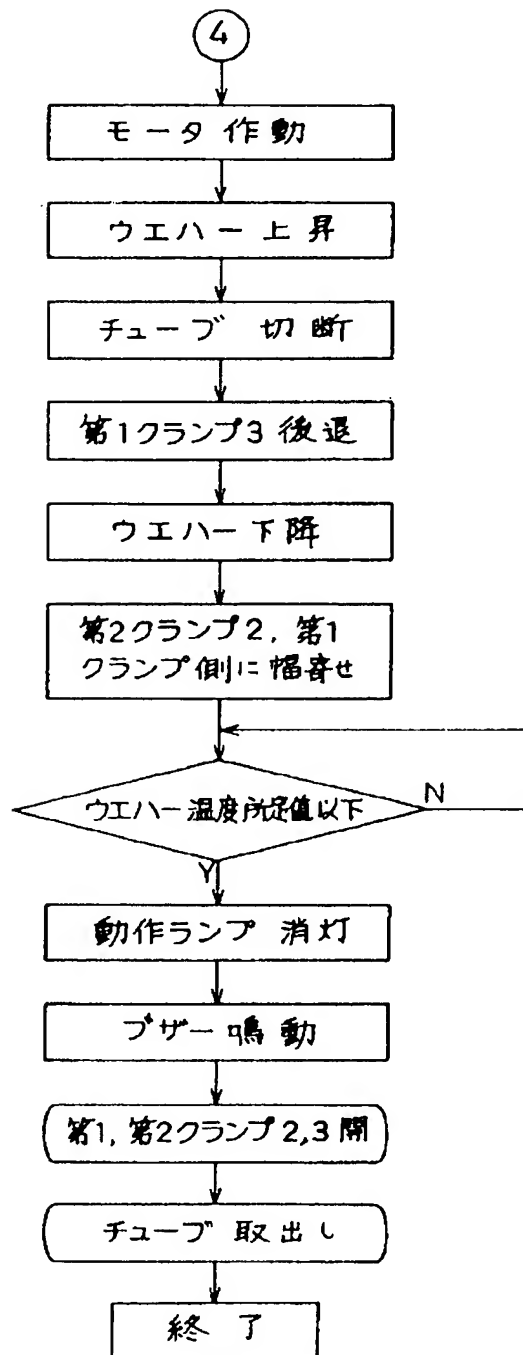
[Drawing 11]



[Drawing 12]

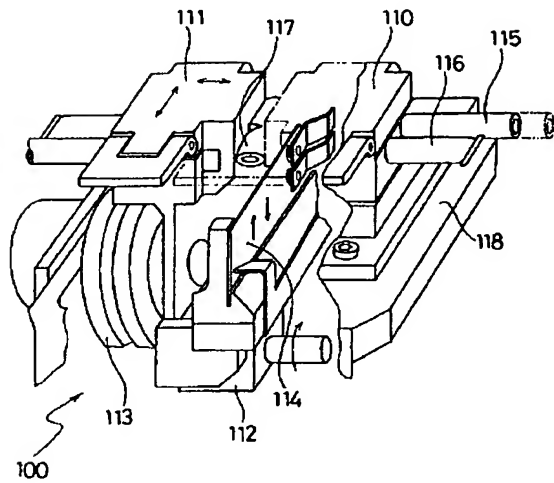


[Drawing 13]

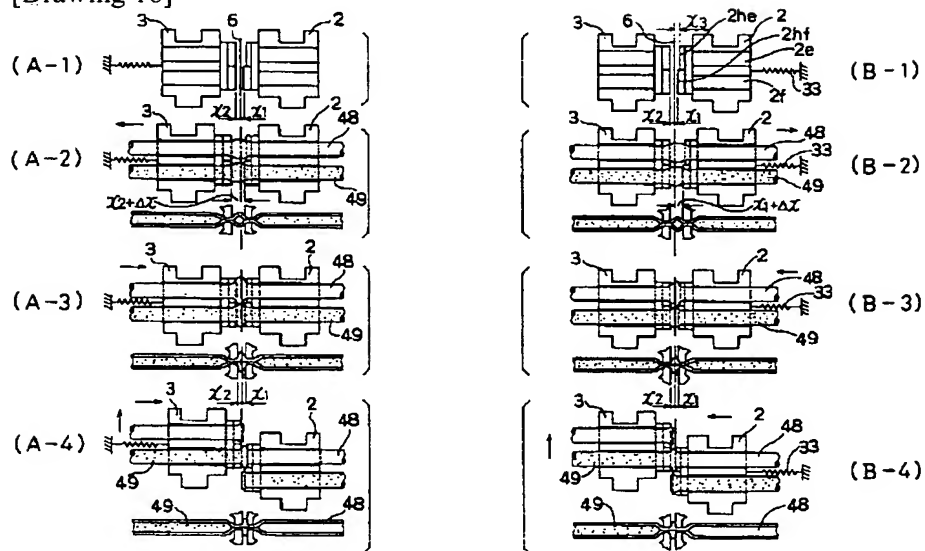


[Drawing 19]





[Drawing 18]



[Translation done.]

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3. In the drawings, any words are not translated.

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**CORRECTION OR AMENDMENT**


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[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law  
 [Section partition] The 2nd partition of the 1st section  
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 [Title of the Invention] Flexible tube sterile junction equipment  
 [Claim(s)]

[Claim 1] Equipment for joining a flexible tube in sterile characterized by providing the following This equipment is the 1st clamp and the 2nd clamp which hold at least two flexible tubes in the parallel condition. The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, and the cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp

[Claim 2] It has the following and said 2nd clamp migration device has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping as two flexible tubes were crushed by the 1st and 2nd clamps and a flexible tube is grasped, Sterile junction equipment characterized by being constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp. the equipment for joining a flexible tube in sterile -- it is -- this equipment -- at least two flexible tubes -- an parallel condition -- and the 1st clamp grasped so that it may crush and the 2nd clamp The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting

means is joined may face each other The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, and the cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention carries out heating fusion of at least two flexible tubes, and relates to the flexible tube sterile junction equipment for connecting in sterile.

[0002]

[Description of the Prior Art] At the time of tube connection of the blood collecting bag in a transfusion system and a constituent-of-blood bag, and exchange of the dialysing fluid bag in continuous ambulatory PD (CAPD), and an effluent bag, it is necessary to connect a tube in sterile. There are some which are shown in JP,61-30582,B as equipment which makes sterile connection of such a tube. The equipment shown in this JP,61-30582,B is a tube contact which carries out heating fusion of the tube and is connected. And illustration of the example of conventional sterile junction equipment has the device as shown in drawing 19. The junction equipment 100 shown in drawing 19 is with the 1st clamp 111 and the 2nd clamp 110 which hold two flexible tubes 115,116 which should be connected in the parallel condition, The cutting means (a wafer) 114 for cutting a flexible tube between the 1st clamp 111 and the 2nd clamp 110, the migration means 113 to which the 1st clamp moves so that both the edges to which the flexible tube cut by the cutting means is joined may face each other through a wafer, and a cutting means 114 move up, melting cutting of the flexible tube carries out, and it has a migration means 112 for moving the wafer after cutting caudad.

[0003] And after heating the sheet metal-like wafer 114, it is with this sterile junction equipment, It is made to move more nearly up than the lower part between the 1st clamp 111 and the 2nd clamp 110. After carrying out melting cutting of the flexible tube 115,116 between the 1st and 2nd clamps, After moving the 1st clamp 111 back so that both the edges to which the cut flexible tube is joined may stick (retreat), a wafer is moved caudad again, both the edges to which a flexible tube is joined are stuck, and it joins.

[0004]

[Problem(s) to be Solved by the Invention] And after a wafer 114 cuts a tube 115,116 between the 1st clamp 111 and the 2nd clamp 110 with above junction equipment, the 1st clamp (left-hand-side clamp) 111 retreats, the wafer 114 which moved to the location where the tube which should be joined faces mutually through a wafer 114, then was heated moves caudad, and the tube which should be joined will be in the condition face mutually. And the 1st clamp (left-hand side clamp) 111 moves to 110 the 2nd clamp side (right clamp side), it is stuck to the tube which should be joined, and both are joined. Therefore, the 2nd clamp (right clamp) 110 is in the condition always fixed to standing ways 118, and the 1st clamp 111 moves to the 2nd clamp side with a motion before and after retreating and moving forward, and it consists of this sterile junction equipment so that both of a motion of the longitudinal direction which returns again may be performed. That is, it is required to move one clamp in the opposite direction, although it is not simultaneous, such structure has a possibility of checking the exact movement toward a clamp, the movement toward a clamp might be made to produce distortion, and poor junction of the tube resulting from this distortion might be produced.

[0005] Then, the purpose of this invention can secure the exact movement toward a clamp, makes distortion of the movement toward a clamp fewer things, and offers the flexible tube sterile junction equipment which can ensure junction of a tube, without making both motion before and after canceling the trouble of the above-mentioned conventional technique and retreating and moving forward to the 1st clamp, and motion of a longitudinal direction which moves to the 2nd clamp side and returns again perform.

[0006]

[Means for Solving the Problem] It is equipment for joining a flexible tube in sterile which attains the above-mentioned purpose. This equipment The 1st clamp and the 2nd clamp which hold at least two flexible tubes in the parallel condition, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, It is flexible tube sterile junction equipment which has the 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, and a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp.

[0007] It is equipment for joining a flexible tube in sterile which attains the above-mentioned purpose. Moreover, this equipment At least two flexible tubes in the parallel condition And the 1st clamp and the 2nd

clamp which are grasped so that it may crush, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, It has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp. Said 2nd clamp migration device It has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping as two flexible tubes were crushed by the 1st and 2nd clamps and a flexible tube is grasped, It is sterile junction equipment constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp.

[0008] And as for said 1st clamp migration device, it is desirable to have the linear table for the 1st clamp which moves in parallel to said 2nd clamp. Furthermore, as for said 2nd clamp migration device, it is desirable to have the linear table for the 2nd clamp which moves in the direction approached and estranged to said 1st clamp.

[0009] Then, the flexible tube sterile junction equipment of this invention is explained with reference to a drawing. It is characterized by equipping this flexible tube sterile junction equipment 1 with the following. The 1st clamp 3 and the 2nd clamp 2 which hold at least two flexible tubes 48 and 49 in the parallel condition The cutting means 5 for cutting the flexible tubes 48 and 49 between the 1st clamp 3 and the 2nd clamp 2 The 1st clamp migration device to which the 1st clamp 3 is moved in parallel to the 2nd clamp 2 so that both the edges to which the flexible tubes 48 and 49 cut by the cutting means 5 are joined may face each other The 2nd clamp migration device moved in the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3, and the cutting means driving means for moving the cutting means 5 up and down in two between the 1st clamp 3 and the 2nd clamp This sterile junction equipment 1 furthermore, as the 1st and 2nd clamps 3 and 2 What grasps them as crushes two flexible tubes 48 and 49 is used. And the 2nd clamp migration device It has the press member 33 which presses the 2nd clamp 2 to the 1st clamp 3 side. And the press member 33 When the thrust of the press member 33 is weaker than the repulsive force of a flexible tube when grasping as two flexible tubes were crushed by the 1st and 2nd clamps 3 and 2 and a flexible tube is grasped, It is constituted so that the 2nd clamp 2 may move in the direction estranged a little from the 1st clamp 3.

[0010] Drawing 1 is the perspective view of one example of the flexible tube sterile junction equipment of this invention. Drawing 2 is the perspective view showing the condition of having contained in the case the sterile junction equipment shown in drawing 1, and drawing 3 is the block diagram showing an example of the electrical circuit used for the sterile junction equipment of this invention. Drawing 4 is the plan of one example of the flexible tube sterile junction equipment of this invention. It explains using drawing 9 which is the perspective view of drawing 8 which is an explanatory view for explaining actuation of drawing 7 which is an explanatory view for explaining actuation of drawing 6 which is an explanatory view for explaining actuation of drawing 1, drawing 2, drawing 3, drawing 4, the 1st clamp, the 2nd clamp, and a cutting means for the sterile junction equipment 1 of this example, and the 1st clamp, and a cutting means, the 1st clamp, and the 2nd clamp.

[0011] Next, the device of the sterile whole junction equipment 1 is explained. This sterile junction equipment 1 has the 1st clamp 3 and the 2nd clamp 2 which hold at least two flexible tubes in the parallel condition, as shown in drawing 1, drawing 2, drawing 4, and drawing 9. By rotation of the gear 30 rotated by actuation of a motor, the gear 31 rotated by rotation of a gear 30, and a gear 31 The arm 18 for a drive for moving the prevention member 11 for preventing shakiness by the home position of the frame 9 to which the both ends of the shaft 32 to rotate and a shaft were fixed pivotable, and the 1st clamp 3, microswitches 13, 14, and 15, and the 1st clamp 3, and the 1st clamp 3 Shakiness of the cam 17 for making the cam 19, the cutting means 5, the cutting means 5, and the 2nd clamp for making it move drive, the press member 33 which presses the 2nd clamp 2 to the 1st clamp side, the specification-part material 25 which regulates the retreat location of the 1st clamp 3, and the 1st clamp 3 The induction member 26 for guiding the spring member 27 for preventing, the wafer exchange lever 22, the wafer cartridge 8, the wafer cartridge exchange lever 24, the used wafer housing grasping member 28, and a used wafer to a housing, the used wafer housing 29, and a control panel 50 It has.

[0012] Moreover, as shown in drawing 3, it is characterized by equipping the sterile junction equipment 1 of this example with the following. The source 43 for wafer heating of a constant voltage which has the rectification power circuit 41 which changes AC power supply into a direct current, and is transformed into a predetermined electrical potential difference The motor 42 by which a power source is similarly supplied

from this source 43 of a constant voltage The controller 40 for controlling a motor 42 and the wafer heating control means 44 The wafer 6 for heating melting to cut a flexible tube, the temperature detection means 7 of this wafer 6, and the wafer heating control means 44 that controls heating of a wafer 6 by controlling the power sent to a wafer 6 from the source 43 of a constant voltage based on the signal from the temperature detection means 7 Moreover, as shown in drawing 5, the connection terminal 39 for connecting the source 43 of a constant voltage and a wafer electrically is formed. And the reset switch for returning equipment is electrically connected to the wafer heating control means 44 after actuation of a wafer short circuit, and the wafer heating control means 44 is electrically connected with the controller 40. Moreover, a microswitch SW1 (13), a microswitch SW2 (14), a microswitch SW3 (15), a microswitch SW4 (72), a microswitch SW5 (73), the microswitch SW6 (74), the electric power switch 51 prepared in the input panel 50, the initiation switch, and the clamp reset switch 53 are electrically connected to the controller 40, and the buzzer 45 which operates further with the signal outputted from a controller 40 is formed. A motor 42 is a driving source which makes the cutting means 5, the 1st clamp 3, and the 2nd clamp 2 drive.

[0013] And it is characterized by equipping this sterile junction equipment 1 with the following. The 1st clamp migration device to which the 1st clamp 3 is moved so that both edges 48a to which the flexible tubes 48 and 49 cut by the cutting means 5 are joined, and 49a may face each other The locomotive function for making a tubeside move the cutting means 5 (to upper part), and making it move in the direction (caudad) again separated from a tube after cutting The 2nd clamp migration device moved in the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3 It is what makes it move to a cutting means drive up perpendicularly to the shaft of two tubes, and moves the cutting means 5 to it caudad after tube cutting. The 1st clamp migration device It is what moves the 1st clamp 3 in the rectangular direction in the level condition to the shaft of two tubes (concrete -- back) after tube cutting. the 2nd clamp migration device The 2nd clamp 2 is moved in parallel very only in the level condition to the shaft of two tubes so that the 1st clamp side may be approached.

[0014] Then, the 1st and 2nd clamps 3 and 2 are explained. The 1st and 2nd clamps 3 and 2 are constituted as shown in drawing 1, drawing 4, drawing 6, and drawing 9. Specifically, the 1st clamp 3 has base 3b, covering 3a attached in this base 3b pivotable, and clamp standing-ways 3c to which base 3b was fixed, as shown in drawing 9. And this clamp standing-ways 3c is being fixed to the linear table. The linear table is constituted by 3n of rail members prepared in the lower part of 3d of movable carriages fixed to the inferior surface of tongue of clamp standing-ways 3c, and 3d of movable carriages. And on this linear table, to the shaft of the tubes 48 and 49 to join, there is no distortion and the 1st clamp 3 is moved so that a perpendicular direction and both the edges to which in other words the cut flexible tube is joined may face each other. Therefore, the 1st clamp migration device is constituted from sterile junction equipment 1 of this example by the above-mentioned linear table, a motor, a gear 30, the gear 31, the shaft 32, the arm 18 for a drive, and the cam 19. And with this junction equipment 1, as shown in drawing 1 and drawing 4, the spring member 27 which connects the back of 1st clamp standing-ways 3c and the frame of junction equipment 1 is formed, the 1st clamp 3 is in the condition of always having been pulled back, and shakiness of the 1st clamp 3 (correctly 1st clamp standing-ways 3c) is made into few things. Moreover, as shown in drawing 1 and drawing 4, the prevention member 11 for preventing shakiness of the 1st clamp 3 in the tube stowed position (location in the condition that in other words the 1st clamp came out to the foremost) of the 1st clamp 3 is being fixed to the side face of a frame 9. Therefore, the 1st clamp 3 is in the condition back pulled by the spring member 27, i.e., the condition which does not have shakiness in a back side, and shakes and can move [ at a tube stowed position ] no longer ahead from it by the prevention member in the front. Therefore, the 1st clamp 3 consists of tube stowed positions so that there may be no shakiness. Moreover, as shown in junction equipment 1 at drawing 1 and drawing 4, the specification-part material 25 which regulates the maximum migration location behind the 1st clamp 3 (correctly 1st clamp standing-ways 3c) is formed.

[0015] The 2nd clamp 2 has clamp standing-ways 2c by which covering 2a attached pivotable and base 2b were fixed to base 2b and this base 2b, as shown in drawing 4, drawing 6, and drawing 9. And this clamp standing-ways 2c is being fixed to the linear table. The linear table is constituted by 2n of rail members prepared in the lower part of 2d of movable carriages fixed to the inferior surface of tongue of clamp standing-ways 2c, and 2d of movable carriages. And on this linear table, to the shaft of the tubes 48 and 49 to join, the 2nd clamp 2 does not have distortion only in an parallel direction and the direction which approaches and estranges the 2nd clamp 2 to the 1st clamp 3, and, in other words, is moved to it.

[0016] Moreover, as shown in drawing 4 and drawing 6, the press member 33 is formed between the frame of junction equipment 1, and clamp standing-ways 2c, and the 2nd clamp 2 (correctly 2nd clamp standing-

ways 2c) is always pushed on the 1st clamp side. As a press member, a spring member is used suitably. And what has the thrust of the press member 33 weaker than the repulsive force of a flexible tube when grasping as two flexible tubes 48 and 49 were crushed by the 1st and 2nd clamps 3 and 2 is used, and when a flexible tube is grasped, this press member 33 is constituted so that the 2nd clamp 2 may move in the direction estranged a little from the 1st clamp 3. Therefore, the 2nd clamp migration device is constituted from sterile junction equipment 1 of this example by the above-mentioned linear table, a motor, a gear 30, the gear 31, the shaft 32, the cam 17, and the press member 33.

[0017] And as shown in drawing 9, the 1st clamp 3 and the 2nd clamp 2 are constituted so that the tube to hold may be held in the condition of having crushed aslant. Clamps 3 and 2 have the coverings 3a and 2a attached in base 3b and 2b possible [ revolution ], and in base 3b and 2b, in order to lay two tubes, they have two slots 3f and 3e established in parallel, and 2f and 2e. And the serrated knife-like lock out members 3h and 2h are formed in the end face of base 3b of the part which Slots 3f and 3e and Slots 2f and 2e face, and 2b. And the lock out members 3g and 2g of the shape of a serrated knife of the configuration corresponding to the lock out members 3h and 2h of the above-mentioned base 3b and 2b are formed in Coverings 3a and 2a. The internal surface of Coverings 3a and 2a is flat. And to Coverings 3a and 2a, it has the revolution cam, respectively, and this revolution cam will engage with the roller of base 3b and 2b, if Coverings 3a and 2a are closed. And when Coverings 3a and 2a are closed, two tubes are aslant crushed by between 3h of lock out members of base 3b, and 3g of lock out members of covering 3a, and between 2h of lock out members of base 2b, and 2g of lock out members of covering 2a, and are held in the condition of having blockaded. Moreover, since the 1st clamp 3 has lobe 3i which projects in the 2nd clamp direction and it has crevice 2i to which the 2nd clamp 2 contains this lobe 3i, the 2nd clamp 2 is constituted so that it cannot blockade, if the 1st clamp 3 is not blockaded.

[0018] Furthermore, the lock out members 2g and 2h of the 2nd clamp 2 have projected a little the tip of lock out member 2hf, and the tip of a part which faces 2hf(s) of 2g of lock out members although not illustrated from the tip of lock out member 2he to the 1st clamp side, as shown in drawing 18. For this reason, the distance X1 of a wafer 6 and lock out member 2hf is narrower than the distance X3 of a wafer 6 and lock out member 2he. Usually, with this sterile junction equipment 1, the tube 49 in use with which the liquid is filled up into the interior is equipped with and joined to the slots 2f and 3f of a near side. The slots 2e and 3e by the side of the back are equipped with the intact tube 48. Therefore, the distance X1 of the wafer 6 which is the side equipped with a tube in use, and lock out member 2hf will become comparatively narrow, and the die length of a clamp 3 and tube 49 part which is located among two and which is not grasped will become short. Therefore, the liquid in the tube 49 located between clamps can be made into few things. Moreover, by making long distance X3 of the wafer 6 which is the side equipped with an intact tube, and lock out member 2he, the intact tube by which melting cutting was carried out with the wafer melts, it can carry out, \*\* can be made [ many ], and junction into the left-hand side part of the cut tube 49 in use becomes a more positive thing.

[0019] And two cams 19 and 17 are being fixed and sterile junction equipment 1 rotates cams 19 and 17 with rotation of a gear 31, as are shown in drawing 1, and it has the gear 30 rotated by the motor, and the gear 31 rotated by rotation of this gear 30 and is shown in the shaft 32 of a gear 31 at drawing 6. And cam-groove 19a for the 1st clamp drive of a configuration as shown in drawing 7 is prepared in the right lateral of a cam 19. And the arm 18 for the 1st clamp migration which has follower 18a which slides on the inside of cam-groove 19a of a cam 19 in the center section is formed. moreover, the lower limit of an arm 18 is supported by the frame 9 rotatable by supporting-point 18b, and the upper limit of an arm 18 is boiled by supporting-point 18c prepared in clamp standing-ways 3c of the 1st clamp 3, and is supported rotatable. Therefore, along with 3n of rail members of a linear table, as shown in drawing 7, the 1st clamp 3 moves to the rectangular direction back in the level condition to the shaft of two tubes by rotation of a cam 19, as shown in an arrow head according to the configuration of cam-groove 19a.

[0020] The cutting means 5 has wafer attaching part 5a which holds a wafer exchangeable, arm section 5c in which wafer attaching part 5a was prepared caudad, follower 5b prepared in the edge of arm section 5c, and 5d of hinge regions and attachment section 5e to a frame 9, as shown in drawing 5. And it can circle to a frame 9 by 5d of hinge regions. And as shown in drawing 5, the temperature detection means 7 for temperature detection of the electrical connection terminal 39 for wafer heating and a wafer is being fixed to the right lateral of the cutting means 5. As a temperature detection means 7, it is desirable that they are a thermocouple or a resistance bulb. More preferably, it is a sheath form thermocouple or a resistance bulb, and a sheath form thermocouple is desirable especially. What has the metal plate bent as a wafer 6 so that it might face each other, the insulating layer formed in the inside of this metal plate, the resistor formed so that



the above-mentioned metal plate might not be contacted in this insulating layer, and the terminal for energization prepared in the both ends of this resistor is used suitably.

[0021] And the cam 17 has cam-groove 17a for a cutting means drive in the left lateral, as shown in drawing 5 and drawing 8. And follower 5b of the cutting means 5 is located in cam-groove 17a of a cam 17, and slides on the inside of cam-groove 17a in accordance with the configuration of a cam groove. Therefore, by rotation of a cam 17, as shown in drawing 8, the cutting means 5 will move to a rectangular cross and the perpendicular direction upper and lower sides to the shaft of two tubes, if it puts in another way up and down according to the configuration of cam-groove 17a. Furthermore, the cam 17 has cam-groove 17c for the drive of the 2nd clamp 2 in the center section, as shown in drawing 6. Cam-groove 17c has 17f of left laterals, and right lateral 17e, and controls the location of the 2nd clamp by 17f of left laterals, and right lateral 17e. In 2nd clamp standing-ways 2c, it has the lobe extended caudad, and the follower 20 is formed at the tip. This follower 20 slides on the inside of cam-groove 17c for the drive of the 2nd clamp 2. And between the side faces of a follower 20 and cam-groove 17c, as shown in drawing 6, it is formed so that the clearance between some may be made. And since 2nd clamp standing-ways 2c is always pushed by the spring member 33, in a normal state, a follower 20 comes to contact 17f of left laterals of cam-groove 17c, and the clearance between some is made between a follower 20 and right lateral 17e of cam-groove 17c. However, as mentioned above, if two tubes are held by the 1st and 2nd clamps 3 and 2, since it blockades and two clamps 3 and 2 hold, respectively so that two tubes may be crushed, they will arise [ the repulsive force resulting from lock out of a tube ]. And in the condition that clamps 3 and 2 hold a tube, since the thing of the force smaller than the repulsive force resulting from lock out of the above-mentioned tube is used, as shown in drawing 6, a follower 20 comes to contact right lateral 17e of cam-groove 17c, and the clearance between some is made by the spring member 33 between a follower 20 and 17f of left laterals of cam-groove 17c. However, if a tube is cut by the above-mentioned cutting means 5, since the repulsive force resulting from lock out of a tube will disappear, return and a follower 20 come to contact 17f of left laterals of cam-groove 17c, and the clearance between some is made in a normal state between a follower 20 and right lateral 17e of cam-groove 17c. Thus, it is constituted so that the sliding surface of the cam groove which a follower 20 contacts may change with an operation of the spring member 33 and the repulsive force of a tube with time.

[0022] And as shown in drawing 6, 17d of crevices is formed in 17f of left laterals. Since the stage when a follower 20 passes 17d part of this crevice is after cutting of a tube by the cutting means, a follower 20 is in the condition which meets and is sliding on 17f of left laterals of a cam groove 17, and, therefore, a follower 20 goes into 17d part of crevices. For this reason, the 2nd clamp 2 will move in the 1st clamp 3 direction by the depth of 17d of crevices. Thereby, junction of a tube becomes more certain. And 17g of crevices is established also in right lateral 17e of cam-groove 17c. 17g of this crevice is a thing for cleaning of the inside of clamps 3 and 2. The 2nd clamp 2 can be moved in the direction estranged from the 1st clamp 3, and, thereby, a clearance is formed between the 1st clamp 3 and the 2nd clamp until a follower 20 contacts 17g of crevices by pushing the 2nd clamp 2 on the spring member 33 side by preparing 17g of this crevice. It becomes possible to clean with the cotton swab containing the solvent which can dissolve the formation ingredient of tubes cut to some extent, such as a cleaning member, for example, alcohol etc., into the formed gap. 17g of this crevice is established in the location which faces mostly 17d (part into which \*\*\*\*\* of the 2nd clamp 2 is performed) of crevices of 17f of left laterals, as shown in drawing 6. When the follower 20 formed in the lobe to which 2nd clamp standing-ways 2c is extended caudad is contained in 17d part of crevices, it is in the condition which joined both the tubes made into the purpose after tube cutting, and the 2nd clamp stops in this condition. Moreover, the 1st clamp is also already stopped and the 1st clamp 3 is in the location which shifted from the 2nd clamp. As shown in drawing 1, the 1st clamp 3 is retreating from the 2nd clamp 2, and, specifically, the 1st clamp 3 has it in the location which shifted from the 2nd clamp. For this reason, in this condition, the inside of the point of the 2nd clamp 2 is exposed a little, and has also exposed the inside of the back end section of the 1st clamp a little further. Therefore, the cleaning is easy for the inside of the 2nd clamp 2 and the 1st clamp 3 which were exposed.

[0023] Next, an operation of the sterile junction equipment 1 of this invention is explained using a drawing. Drawing 10 is a timing chart which shows actuation of a cutting means, the 1st clamp, and the 2nd clamp. Drawing 11, drawing 12, and drawing 13 are the flow charts for explaining an operation of sterile junction equipment. Drawing 14, drawing 15, drawing 16, and drawing 17 are the explanatory views for explaining an operation of sterile junction equipment. Drawing 18 is an explanatory view for explaining the movement toward the 1st and 2nd clamps of sterile junction equipment 1, and the grasping condition of a tube. With this junction equipment 1, the 1st clamp 3 at the time of junction activity termination serves as a location

which shifted from the 2nd clamp 2, and is in the halt location of the timing chart of drawing 10. The include angle of the axis of abscissa of the timing chart of drawing 10 makes 0 degree a zero (condition whose location of the 1st clamp and the 2nd clamp suits), and, in other words, are angle of rotation of the shaft 32 of the subsequent gear 31, and a thing which shows the movement toward the cutting means at the time of angle of rotation of a cam 17 and a cam 19 (wafer), the 1st clamp 3, and the 2nd clamp 2.

[0024] First, as first shown in drawing 11 of a flow chart, the electric power switch 51 prepared in the panel 50 of drawing 3 is pushed. By CPU which constitutes by this the controller 40 shown in drawing 3, when it judges whether it is normal (isn't there any omission of an internal connector, or isn't there specifically any open circuit of a thermocouple, or isn't there any defect in the source of an internal constant voltage?) and is abnormal, a buzzer carries out singing of the junction equipment 1. Then, the clamp reset switch 53 prepared in the panel 50 of drawing 3 is pushed. By CPU, it judges whether the 1st and 2nd clamps are open, whether there are any 1st and 2nd clamps in a zero, and whether a wafer exchange lever is in a zero. In addition, since the clamp used with the sterile junction equipment 1 of this example has lobe 3i to which the 1st clamp 3 projects in the 2nd clamp direction as mentioned above and it has crevice 2i to which the 2nd clamp 2 contains this lobe 3i, the 2nd clamp 2 is constituted so that it cannot blockade, if the 1st clamp 3 is not blockaded. For this reason, it is detected by the microswitch 13 with which ON/OFF of the 1st and 2nd clamps being open is carried out by the lever 16 which contacts, and this lever 16 when the 2nd clamp is blockaded. When the 2nd clamp is in a release condition, OFF has come, when the 2nd clamp 2 is blockaded, a lever 16 is contacted, a lever 16 moves, and, specifically, a microswitch 13 makes a microswitch 13 ON condition. The ON/OFF signal of this microswitch 13 is inputted into a controller 40. It is judged that there are no 1st and 2nd clamps in a zero when a microswitch SW5 (73) and SW6 (74) detect the slot prepared on the periphery of each cam. It is detected by the microswitch 14 that the wafer exchange lever 22 is in a zero. When a microswitch 14 serves as ON when a lever 22 is in a zero, and there is nothing at a zero, OFF comes and the ON/OFF signal of this microswitch 14 is inputted into a controller 40.

[0025] And as shown in drawing 11, when all four above-mentioned points are YES(s), a motor is operated and the 1st and 2nd clamps are returned to a zero. Moreover, an abnormality lamp puts out the light by in No, BUSA's carrying out singing, and an abnormality lamp's lighting up, performing manual discharge, and pushing at least one reset switch among four above-mentioned points. After the 1st and 2nd clamps arrive at a zero, the 1st and 2nd clamps are equipped with two flexible tubes 48 and 49. The 1st and 2nd clamps 3 and 2 in this condition are in the condition that 2f faced mutually slot 3e which is in the condition which both opened wide, and was prepared for both, and 2e and 3f, as [ show / in drawing 9 ]. And the slots 3f and 2f of a near side are equipped with the tube 49 in use, and the slots 3e and 2e by the side of the back are equipped with the intact tube 48 connected.

[0026] And after blockading the 1st and 2nd clamps 3 and 2 as mentioned above, the wafer exchange lever 22 is pushed on a clamp side, and wafers are exchanged. By lengthening the wafer exchange lever 22 to a clamp side, a wafer newer than the inside of the wafer cartridge 8 is taken out, and while push and a standby wafer are equipped with the used wafer with which push and a standby wafer were equipped with the standby wafer with which the cutting means 5 is equipped with a new wafer by the cutting means 5 in an operating location, a used wafer is contained in the used wafer housing 29. By then, CPU which constitutes the controller 40 which will shift to \*\* of the flow chart of drawing 12 if the initiation switch of a panel 50 is pushed, and is shown in drawing 3 [ whether the 1st and 2nd clamps have closed, whether a wafer is exchange settled, and ] Whether the 1st and 2nd clamps are in a zero, whether a wafer exchange lever is in a zero, and whether the 1st and 2nd clamps have closed When the 2nd clamp is blockaded, it is detected by the lever 16 which contacts, and the microswitch 13 in which ON/OFF is carried out by this lever 16. When the 2nd clamp is in a release condition, OFF has come, when the 2nd clamp 2 is blockaded, a lever 16 is contacted, a lever 16 moves, and, specifically, a microswitch 13 makes a microswitch 13 ON condition. The ON/OFF signal of this microswitch 13 is inputted into a controller 40. If whether a wafer is exchange settled does push and a wafer exchange activity in the clamp direction for the wafer exchange lever 22, since the exchange lever 22 makes a microswitch 15 turn on once, it will be detected whether it was exchanged by ON signal from a microswitch 15. The ON/OFF signal of a microswitch 15 is inputted into a controller 40. Whether the 1st and 2nd clamps are in a zero detects with a microswitch 13 as mentioned above.

[0027] And as shown in drawing 12, in No, BUSA carries out singing and returns to \*\* of drawing 11 at least one of the four above-mentioned points. Moreover, when all the four above-mentioned points are YES (s), the working lamp 47 lights up and heating of a wafer is started. It is for or or judging [ whose a wafer current is beyond the set point ] whether a judgment was made and the wafer has short-circuited this after heating initiation of a wafer. And when a wafer current is not beyond the set point (the electrical potential

difference concerning shunt resistance beyond a predetermined value), after waiting for 0.3 seconds, it judges whether a wafer current is set point within the limits. When a wafer is a used thing, since resistance falls for the heat history of a resistor, this measures a wafer current, detects whether it is in a setting range (inside of tolerance) as compared with the wafer current set up beforehand, and, thereby, judges electrically whether a wafer is used. After BUSA carries out singing, suspending heating of a wafer, and the abnormality lamp in a wafer lighting up and pushing a reset switch when the above-mentioned wafer current is beyond the set point, and when an above-mentioned wafer current is not in a setting range (when the wafer has short-circuited) (when a wafer is used), it shifts to flow chart \*\* of drawing 11. And heating of a wafer is continued when it is in a setting range (inside of tolerance) as compared with a wafer current. Heating of a wafer 6 is performed controlling the source 43 of a constant voltage by the Pulse-Density-Modulation signal computed based on the temperature detection output of the thermocouple 7 which is a wafer temperature detection means. and in order to prevent superfluous heating of a wafer, when it judges whether the heating time of a wafer is predetermined within a time, and it judges whether a wafer current is predetermined value within the limits and beyond the predetermined value, i.e., a wafer, has caused short circuit accident, immediately, BUSA carries out singing, suspends heating of a wafer, and shifts to flow chart \*\* of drawing 11. And if the temperature of a wafer reaches laying temperature, it shifts to flow chart \*\* of drawing 13, and a motor operates, thereby, a gear 30, a gear 31, and cams 19 and 17 will rotate, a cutting means (wafer) will go up, and \*\*\*\*\* by the side of cutting of a tube, retreat of the 1st clamp, descent of a cutting means (wafer), and the 1st clamp of the 2nd clamp will be performed.

[0028] And as shown in the flow chart of drawing 13, a rise of a wafer, cutting of a tube, retreat of the 1st clamp, and descent of a wafer are performed in each sequence. If it explains concretely, follower 5b of the cutting means 5 will slide on the inside of cam-groove 17a first by rotating in the direction of an arrow head which a cam 17 shows to drawing 8. From the condition that the zero O of a cam groove shown in drawing 8 and drawing 10 at the beginning touched follower 5b, the point A of cam-groove 17a shown in drawing 8 and drawing 10 comes to contact follower 5b. And as shown in drawing 10, gently-sloping, the cutting means 5 goes up and two flexible tubes are cut from the condition that the point A of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b in the meantime, until the point B of cam-groove 17a results in the condition of contacting follower 5b. If it explains using drawing 14 and drawing 15, two tubes 48 and 49 are held by the 1st clamp 3 and the 2nd clamp 2, the tube parts 48a and 49a located between the 1st clamp 3 and the 2nd clamp 2 are formed, and the wafer 6 of a cutting means is located in the lower part. And as mentioned above, by rotation of a cam 17, when the cutting means 5 (wafer 6) goes up, as shown in drawing 15, melting cutting of both is carried out in the tube parts 48a and 49a located between the 1st clamp 3 of two tubes, and the 2nd clamp 2.

[0029] And as shown in drawing 8 and drawing 10, the condition that the cutting means 5 went up is maintained, and the edge from which Tubes 48a and 49a were cut is fully dissolved, until it results in the condition that the point C of cam-groove 17a contacts follower 5b from the condition that the point B of cam-groove 17a shown in drawing 8 contacts follower 5b. And as shown in drawing 8 and drawing 10, the cutting means 5 descends gently-sloping, until the point E of cam-groove 17a results [ from the condition that the point C of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b ] in the condition of contacting follower 5b. Moreover, as shown in drawing 7, when a cam 19 rotates in the direction of an arrow head, follower 18a prepared in the arm 18 for moving the 1st clamp slides on the inside of cam-groove 19a. From the condition that the zero O of a cam groove shown in drawing 7 and drawing 10 at the beginning touched follower 18a, the point F of cam-groove 19a shown in drawing 7 and drawing 10 comes to contact follower 18a. As shown in the timing chart of drawing 10, follower 18a results in cam-groove 19 a point F early a little rather than follower 5b of the cutting means 5 results in the point B of cam-groove 17a. And as shown in drawing 10, gradually, the 1st clamp 3 retreats, will be in the condition which shows in drawing 16, and will be in the condition that the tube parts 49a and 48a joined faced each other through the wafer 6, until the point G of cam-groove 19a results [ from the condition that the point F of cam-groove 19a contacts follower 18a ] in the condition of contacting follower 18a, as shown in drawing 7 and drawing 10. As shown in the timing chart of drawing 10, this condition is maintained from the condition that the point G of cam-groove 19a contacts follower 18a until the point C of cam-groove 17a results in the condition of contacting follower 5b. And the condition of drawing 16 is maintained until the location of the 1st clamp results [ from the condition that Point G contacts follower 18a ] in the condition that the point H of cam-groove 19a contacts follower 18a. In addition, as the cutting means 5 is shown in drawing 8 and drawing 10 until the point E of cam-groove 17a results [ from the condition that the point C of cam-groove 17a shown in drawing 8 and drawing 10 contacts follower 5b as mentioned above ] in the

condition of contacting follower 5b, it descends gently-sloping and the tube parts 48a and 49a joined contact.

[0030] And with the time of resulting in the condition which descent of the cutting means 5 ended, and the condition that the point E of cam-groove 17a contacts follower 5b, mostly, as shown in drawing 6 and drawing 10, in other words, the 2nd clamp 2 performs \*\*\*\*\* to coincidence at the 1st clamp side. As shown in drawing 6 and drawing 10, specifically the point M of 17d of crevices of 17f of left laterals of cam-groove 17c Gradually until the point L of a left lateral results [ from the condition of contacting the follower 20 for making the 2nd clamp 2 driving ] in the condition of contacting a follower 20 the 2nd clamp 2 moves to the 1st clamp 3 side, and the condition of having \*\*\*\*\* (ed) is maintained until the point K of 17d of crevices results [ from the condition that the point L of 17d of crevices of cam-groove 17c contacts a follower 20 ] in the condition of contacting a follower 20. By this \*\*\*\*\* , since both of the tube parts 48a and 49a stick certainly, they can make both junction a more positive thing. And gradually, the 2nd clamp 2 moves in the direction separated from the 1st clamp 3 side, and actuation of a motor stops it to this \*\*\*\*\* until the point J of 17f of left laterals results [ from the condition that the point K of 17d of crevices of cam-groove 17c contacts a follower 20 ] in the condition of contacting a follower 20.

[0031] Therefore, the location of the 1st clamp 3 and the 2nd clamp 2 in the stopped location is the location shifted like drawing 16, as shown in drawing 17. And if wafer temperature is detected by the thermocouple and wafer temperature becomes below the set point as shown in the flow chart of drawing 13, a run light will put out the light and BUSA will carry out singing. And as shown in drawing 17, the junction activity of a tube is completed by opening the 1st clamp 3 and the 2nd clamp 2, and taking out a tube.

[0032] The 1st clamp and the 2nd clamp consist of conventional sterile junction equipment so that they may be grasped, as two tubes are crushed. And as shown in (A-1) of drawing 18, the front part of the 1st clamp 3 is estranged distance X2 with the wafer 6, and the 2nd clamp 2 is estranged distance X1 with the wafer 6. In the condition that both of the 1st and 2nd clamps 3 and 2 were fixed completely, as the part during the 1st and 2nd clamps of two crushed tubes is shown in (A-2) of drawing 18, trouble will be caused to the junction of a tube which will be in the condition of having swollen and is performed behind. For this reason, since the 2nd clamp 2 (right clamp) is being fixed, it is pushed on the repulsive force of a tube when grasping the 1st clamp 3 (left clamp), as two tubes were crushed, and as shown in (A-2) of drawing 18, it consists of conventional junction equipment so that the 1st clamp may move in the direction separated from the 2nd clamp a little. Thereby, distance (X2+\*\*x) alienation of the 1st clamp 3 is carried out with a wafer 6. Moreover, after the repulsive force of a tube disappears (i.e., after a tube is cut by the wafer), as shown in (A-3) of drawing 18, the spring which presses the 1st clamp to the 2nd clamp side is prepared so that it may move in the direction which approaches the 2nd clamp side again.

[0033] Moreover, with this kind of junction equipment, it equips with the tube 49 in use with which the liquid was filled up into the slit of the near side of a clamp, the slit by the side of the back of a clamp is equipped with the intact tube 48 for connection, and both are joined. However, with conventional junction equipment, as shown in (A-2) of drawing 18, in order that the 1st clamp 3 may move to left-hand side by having grasped tubes 48 and 49, a wafer 6 will be inserted between the 1st clamp 3 and the 2nd clamp 2, and the right-hand side of the part which swelled a little will be cut. When the liquid exists in the interior of the part which swelled a little in many cases and the right-hand side is cut, as it is inserted between the 1st clamp 3 of a tube, and the 2nd clamp 2 during use, and it is shown in (A-3) of drawing 18, the liquid which existed may remain in a wafer front face, it may originate in this, and poor junction of a tube may arise. However, with the sterile junction equipment 1 of this invention, the end face by the side of the 1st clamp of the tube joined can be made into a more beautiful end face, and junction of a tube can be ensured.

[0034] As by carrying out melting cutting of the tube with the wafer with which the 1st clamp which moved in the direction separated from the 2nd clamp according to the repulsive force by grasping a tube as the sterile junction equipment of the former shows to (A-2) of drawing 18, when it explains concretely was heated shows to (A-3) of drawing 18, it moves to the 2nd clamp side again. Therefore, in the phase (A-3) of drawing 18, the tube ingredient and contents for die length equivalent to the migration length (\*\*x) by the side of the 2nd clamp of the 1st clamp will fuse and adhere to a wafer front face (the 2nd clamp side front face of a wafer). And as shown in (A-4) of drawing 18, the 1st clamp is back moved for junction of a tube. The end face by the side of the 1st clamp of the tube joined in order to move so that the melting resin and contents adhering to a wafer front face may be dragged at this time cannot turn into a beautiful end face easily, may originate in this, a wafer may move caudad, and poor tube junction may be produced in a part for the joint of the tube formed after being stuck to both the tubes joined.

[0035] Like conventional junction equipment, the 1st clamp and the 2nd clamp are constituted by the sterile

junction equipment 1 of this invention so that they may be grasped, as two tubes are crushed. And as shown in (B-1) of drawing 18, the front part of the 1st clamp 3 is estranged distance  $X_1$  with the wafer 6, and the 2nd clamp 2 is estranged distance  $X_2$  with the wafer 6. And as shown in (B-2) on the left-hand side of drawing 18, it is pushed on the repulsive force of a tube when grasping the 1st clamp 3 (left clamp), as two tubes were crushed, and it is constituted so that the 2nd clamp may move in the direction separated from the 1st clamp a little, and, thereby, distance  $(X_1 + \Delta x)$  alienation of the 2nd clamp 2 is carried out with a wafer 6. Moreover, after the repulsive force of a tube disappears (i.e., after a tube is cut by the wafer), as shown in (B-3) of drawing 18, the 2nd clamp 2 is pushed by the spring member 33, and moves in the direction which approaches the 1st clamp 3 side again.

[0036] Therefore, with the junction equipment 1 of this invention, in order that the 2nd clamp may move to right-hand side when clamps 3 and 2 grasped tubes 48 and 49 as shown in (B-2) of drawing 18, a wafer 6 will be inserted between the 1st clamp 3 and the 2nd clamp 2, and the left-hand side of the part which swelled a little will be cut. It is inserted between the 1st clamp 3 of a tube 49, and the 2nd clamp 2 during use, and the liquid exists in the interior of the part which swelled a little in many cases. However, since left-hand side is cut, poor junction of the tube resulting from the liquid which the liquid which existed did not remain in a wafer front face, and remained in the wafer front face can be prevented.

[0037] Furthermore, with the junction equipment 1 of this invention, by carrying out melting cutting of the tube with the heated wafer, the 2nd clamp 2 moves the 2nd clamp to the 1st clamp side again, as shown in (B-3) of drawing 18. Therefore, in the phase (B-3) of drawing 18, the tube ingredient for the die length equivalent to the migration length  $(\Delta x)$  by the side of the 1st clamp of the 2nd clamp will fuse and adhere to a wafer front face (the 2nd clamp side front face of a wafer). And as shown in (B-4) of drawing 18, the 1st clamp is back moved for junction of a tube. Since there is little adhesion of the resin and contents which were fused in the 1st clamp side front face of a wafer compared with the 2nd clamp side front face at this time, it is rare to move so that the melting resin and contents adhering to a wafer front face may be dragged, and it can make beautiful the end face by the side of the 1st clamp of the tube joined. Moreover, on the 2nd clamp side front face of a wafer adhering [ many ], since migration of a tube is not performed, the end face by the side of the 2nd clamp of the tube joined can also make melting resin beautiful. Therefore, it is rare to produce poor tube junction in a part for the joint of the tube formed after being stuck to both the tubes joined.

[0038]

[Effect of the Invention] The sterile junction equipment of this invention is equipment for joining a flexible tube in sterile. This equipment The 1st clamp and the 2nd clamp which hold at least two flexible tubes in the parallel condition, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, Since it has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp, the 1st clamp Since only the motion before and after retreat and advance performs only the motion which approaches the 1st clamp side and is estranged, it can secure the exact movement toward each clamp, can make distortion of the movement toward a clamp fewer things, and, as for a deed and the 2nd clamp, can ensure junction of a tube.

[0039] Moreover, the flexible tube sterile junction equipment of this invention It is equipment for joining a flexible tube in sterile. This equipment At least two flexible tubes in the parallel condition And the 1st clamp and the 2nd clamp which are grasped so that it may crush, The cutting means for cutting said flexible tube between this 1st clamp and the 2nd clamp, The 1st clamp migration device to which said 1st clamp is moved in parallel to said 2nd clamp so that both the edges to which the flexible tube cut by this cutting means is joined may face each other, The 2nd clamp migration device moved in the direction which approaches and estranges said 2nd clamp to said 1st clamp, It has a cutting means driving means for moving said cutting means up and down between said 1st clamp and the 2nd clamp. Said 2nd clamp migration device It has the press member which presses said 2nd clamp to said 1st clamp side. And this press member When the thrust of this press member is weaker than the repulsive force of a flexible tube when grasping as two flexible tubes were crushed by the 1st and 2nd clamps and a flexible tube is grasped, Since it is constituted so that the 2nd clamp may move in the direction estranged a little from the 1st clamp, as mentioned above the 1st clamp Since only the motion before and after retreat and advance performs only the motion which approaches the 1st clamp side and is estranged, it can secure the exact movement toward each clamp, can make distortion of the movement toward a clamp fewer things, and, as for a deed and the 2nd

clamp, can ensure junction of a tube. With the junction equipment of this invention, it is back moved for junction of a tube. Furthermore, in the front face (wafer front face by the side of the 1st clamp) of a near wafer Since there is little adhesion of the resin and contents which were fused compared with the wafer front face (wafer front face by the side of the 2nd clamp) of the opposite side It is rare to move so that the melting resin and contents adhering to a wafer front face may be dragged. It is rare to produce poor tube junction in a part for the joint of the tube formed after being stuck to both the tubes that can make beautiful the end face by the side of the 1st clamp of the tube joined, and are joined.

[Brief Description of the Drawings]

[Drawing 1] Drawing 1 is the perspective view of one example of the flexible tube sterile junction equipment of this invention.

[Drawing 2] Drawing 2 is the perspective view showing the condition of having contained in the case the sterile junction equipment shown in drawing 1.

[Drawing 3] Drawing 3 is the block diagram showing an example of the electrical circuit used for the sterile junction equipment of this invention.

[Drawing 4] Drawing 4 is the plan of one example of the flexible tube sterile junction equipment of this invention.

[Drawing 5] Drawing 5 is the left side view showing an example of the cutting means used for the junction equipment of this invention.

[Drawing 6] Drawing 6 is an explanatory view for explaining actuation of the 1st clamp, the 2nd clamp, and a cutting means.

[Drawing 7] Drawing 7 is an explanatory view for explaining actuation of the 1st clamp.

[Drawing 8] Drawing 8 is an explanatory view for explaining actuation of a cutting means.

[Drawing 9] Drawing 9 is the perspective view showing an example of the 1st and 2nd clamps used for the sterile junction equipment of this invention.

[Drawing 10] Drawing 10 is a timing chart which shows the timing of the 1st clamp, the 2nd clamp, and a cutting means of operation.

[Drawing 11] Drawing 11 is a flow chart for explaining an operation of the sterile junction equipment of this invention.

[Drawing 12] Drawing 12 is a flow chart for explaining an operation of the sterile junction equipment of this invention.

[Drawing 13] Drawing 13 is a flow chart for explaining an operation of the sterile junction equipment of this invention.

[Drawing 14] Drawing 14 is an explanatory view for explaining an operation of the sterile junction equipment of this invention.

[Drawing 15] Drawing 15 is an explanatory view for explaining an operation of the sterile junction equipment of this invention.

[Drawing 16] Drawing 16 is an explanatory view for explaining an operation of the sterile junction equipment of this invention.

[Drawing 17] Drawing 17 is an explanatory view for explaining an operation of the sterile junction equipment of this invention.

[Drawing 18] Drawing 18 is an explanatory view for explaining the movement toward the 1st and 2nd clamps of sterile junction equipment, and the grasping condition of a tube.

[Drawing 19] Drawing 19 is the perspective view of conventional flexible tube sterile junction equipment.

[Description of Notations]

1 Sterile Junction Equipment

2 2nd Clamp

3 1st Clamp

3d Movable carriage of a linear table

3n Rail member of a linear table

33 Press Member

5 Cutting Means

6 Wafer

7 Wafer Temperature Detection Means

9 Frame

13 Microswitch 1

14 Microswitch 2



15 Microswitch 3  
 48 Tube  
 49 Tube  
 40 Controller  
 41 Rectification Power Circuit  
 42 Motor  
 43 Source of Constant Voltage  
 44 Wafer Heating Control Means  
 50 Input Panel

[Procedure amendment 2]

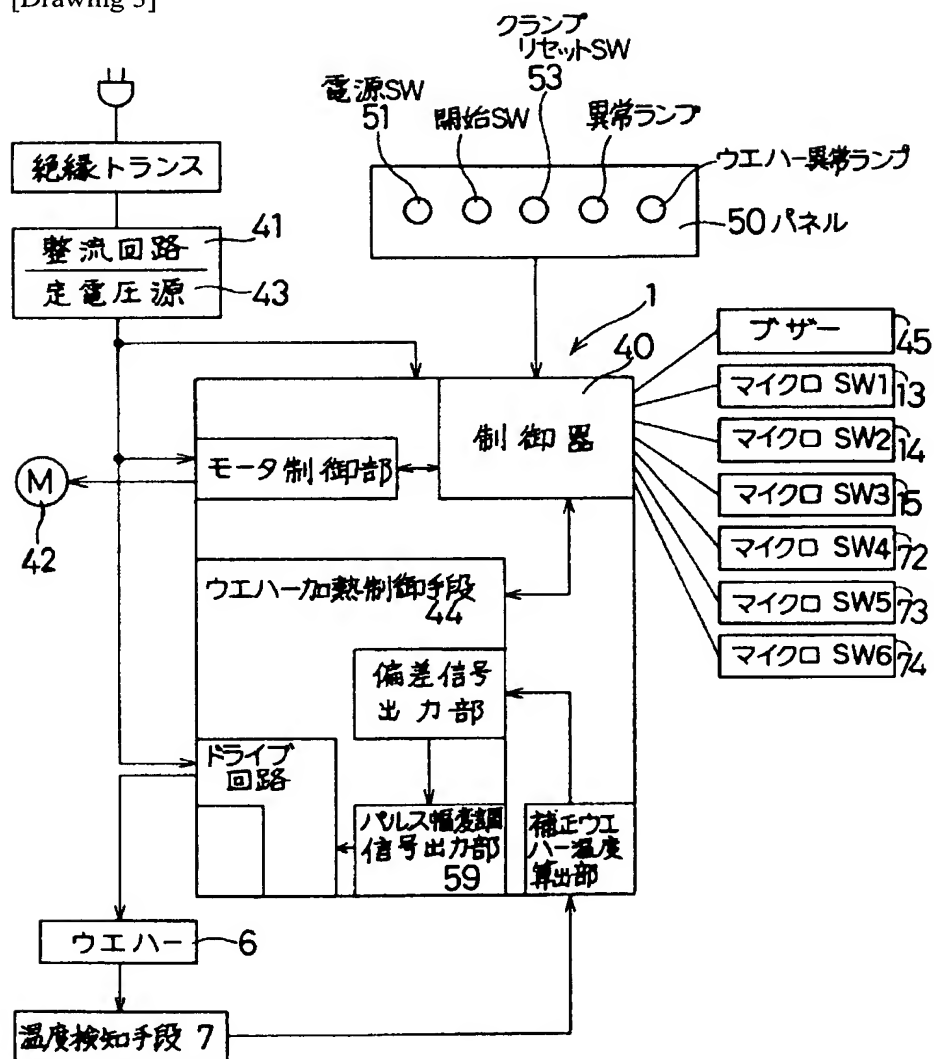
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[Method of Amendment] Modification

[Proposed Amendment]

[Drawing 3]



[Procedure amendment 3]

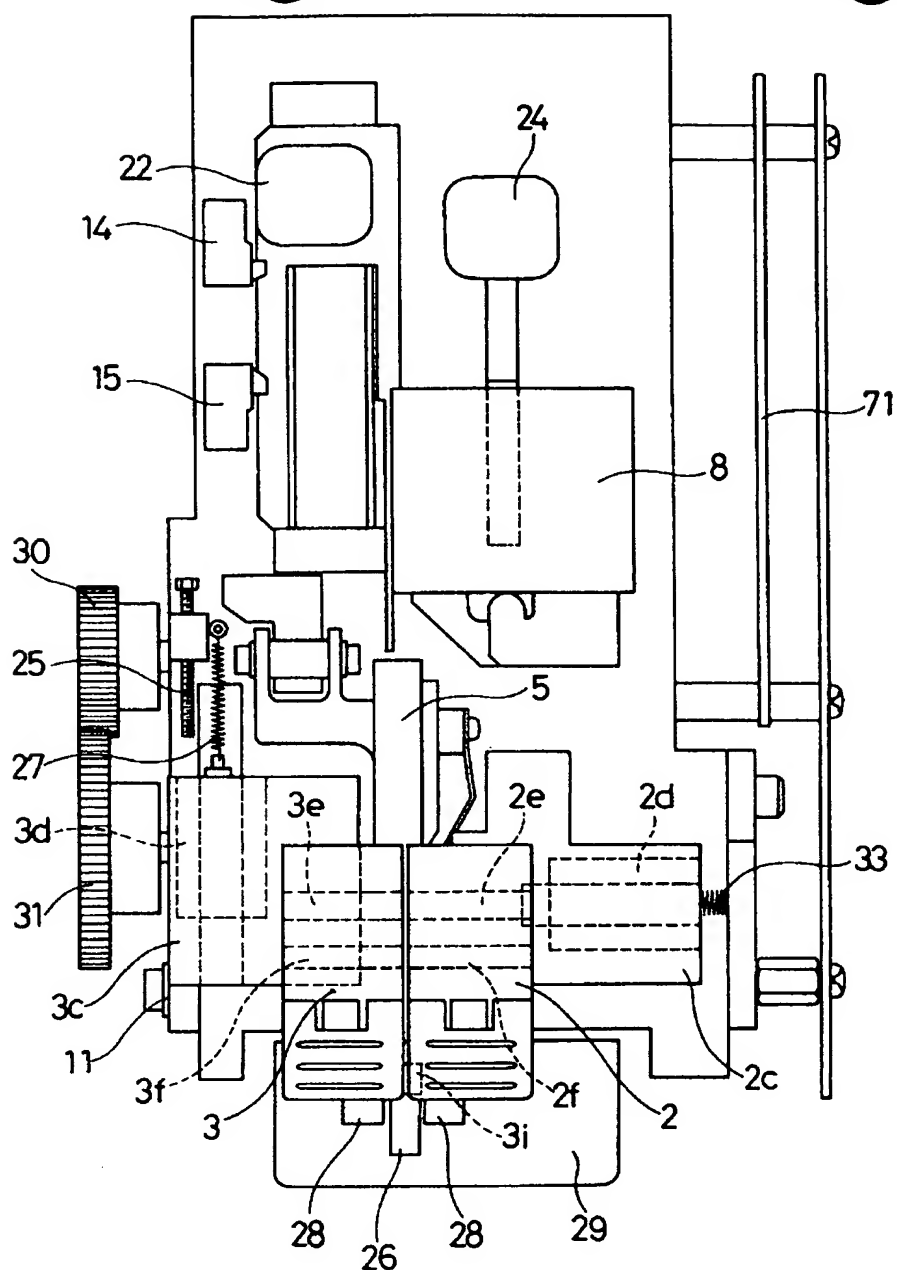
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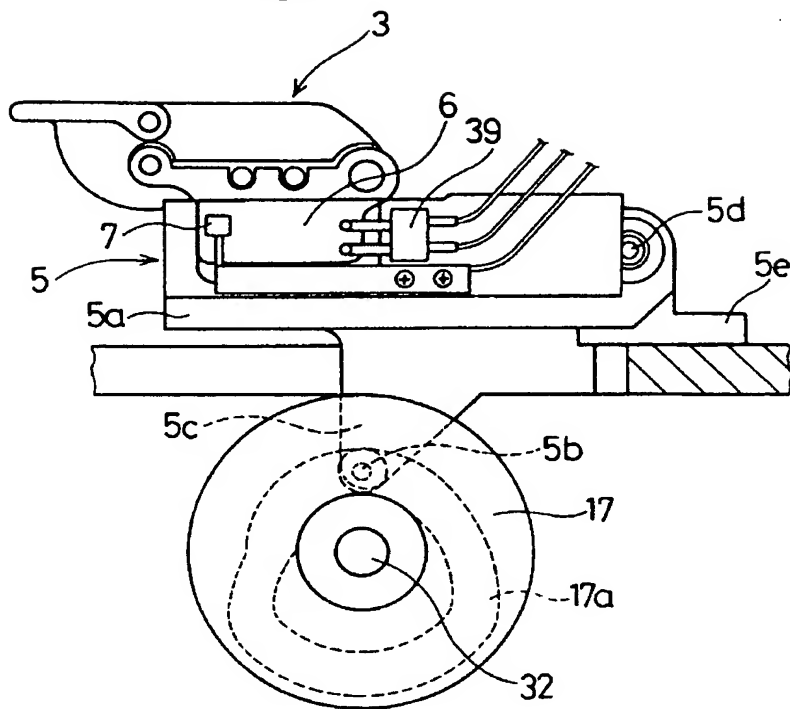
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[Proposed Amendment]

[Drawing 4]



[Procedure amendment 4]  
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 [Drawing 5]



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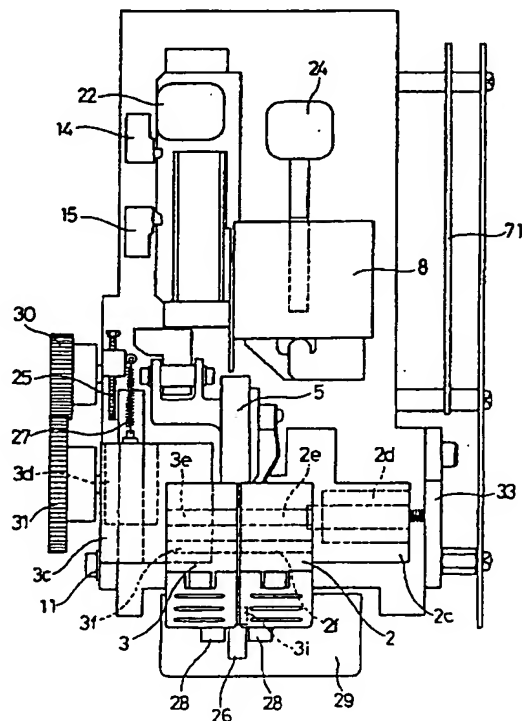
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(54)【発明の名称】可撓性チューブ無菌的接合装置

(57)【要約】

【目的】 第1クランプに、後退、前進する前後の動きと、第2クランプ側に移動し、再び戻る、横方向の動きの両者を行わせることなく、クランプの動きの歪みをより少ないものとし、チューブの接合を確実に行うことができる可撓性チューブ無菌的接合装置を提供する。

【構成】 可撓性チューブを無菌的に接合するための装置であり、2本の可撓性チューブを平行状態にて保持する第1クランプおよび第2クランプと、第1および第2クランプ3, 2間にて可撓性チューブ4 8, 4 9を切断するための切断手段5とその駆動手段と、切断された可撓性チューブ4 8, 4 9の接合される端部相互が向かい合うように第1クランプを前記第2クランプに対して平行に移動させる第1クランプ移動機構と、第2クランプを第1クランプに対して、近接および離間する方向に移動させる第2クランプ移動機構とを有する。



## 【特許請求の範囲】

【請求項 1】 可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも 2 本の可撓性チューブを平行状態にて保持する第 1 クランプおよび第 2 クランプと、該第 1 クランプおよび第 2 クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第 1 クランプを前記第 2 クランプに対して平行に移動させる第 1 クランプ移動機構と、前記第 2 クランプを前記第 1 クランプに対して、近接および離間する方向に移動させる第 2 クランプ移動機構と、前記切断手段を前記第 1 クランプおよび第 2 クランプ間にて上下動させるための切断手段駆動手段とを有することを特徴とする可撓性チューブ無菌的接合装置。

【請求項 2】 可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも 2 本の可撓性チューブを平行状態にて、かつ押し潰すように把持する第 1 クランプおよび第 2 クランプと、該第 1 クランプおよび第 2 クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第 1 クランプを前記第 2 クランプに対して平行に移動させる第 1 クランプ移動機構と、前記第 2 クランプを前記第 1 クランプに対して、近接および離間する方向に移動させる第 2 クランプ移動機構と、前記切断手段を前記第 1 クランプおよび第 2 クランプ間にて上下動させるための切断手段駆動手段とを有し、前記第 2 クランプ移動機構は、前記第 2 クランプを前記第 1 クランプ側に押圧する押圧部材を有し、かつ、該押圧部材は、第 1 および第 2 クランプにより 2 本の可撓性チューブを押し潰すようにして把持した時の、可撓性チューブの反発力より該押圧部材の押圧力は弱く、可撓性チューブを把持したとき、第 2 クランプが第 1 クランプより若干離間する方向に動くように構成されていることを特徴とする無菌的接合装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】 本発明は、少なくとも 2 本の可撓性チューブを加熱溶融して、無菌的に接続するための可撓性チューブ無菌的接合装置に関する。

## 【0002】

【従来の技術】 輸血システムにおける採血バッグおよび血液成分バッグのチューブ接続、持続的腹膜透析 (CAPD) における透析液バッグと排液バッグの交換時などには、チューブの接続を無菌的に行うことが必要となる。このようなチューブの無菌的接続を行う装置としては、特公昭 61-30582 号公報に示されものがある。この特公昭 61-30582 号公報に示されている装置は、チューブを加熱溶融して接続するチューブ接続

装置である。そして、従来の無菌的接合装置の具体例を図示すると、図 19 に示すような機構を有している。図 19 に示す接合装置 100 は、接続すべき 2 本の可撓性チューブ 115, 116 を平行状態にて保持する第 1 クランプ 111 および第 2 クランプ 110 と、第 1 クランプ 111 および第 2 クランプ 110 間にて可撓性チューブを切断するための切断手段 (ウエハー) 114 と、切断手段により切断された可撓性チューブの接合される端部相互がウエハーを介して向かい合うように第 1 クランプを移動させる移動手段 113 と、切断手段 114 を上方に移動させて可撓性チューブを溶融切断させ、切断後ウエハーを下方に移動させるための移動手段 112 を有している。

【0003】そして、この無菌的接合装置では、薄板状のウエハー 114 を加熱後、第 1 クランプ 111 および第 2 クランプ 110 間の下方より、上方に移動させて、第 1 および第 2 クランプ間にて、可撓性チューブ 115, 116 を溶融切断した後、切断された可撓性チューブの接合される端部相互が密着するように第 1 クランプ 111 を後方に移動 (後退) させた後、再びウエハーを下方に移動させて、可撓性チューブの接合される端部相互を密着させて接合する。

## 【0004】

【発明が解決しようとする課題】そして、上記の接合装置では、ウエハー 114 により第 1 クランプ 111 および第 2 クランプ 110 間にて、チューブ 115, 116 を切断した後、第 1 クランプ (左側クランプ) 111 が後退し、接合すべきチューブがウエハー 114 を介して、相互に向かい合う位置に移動し、続いて、加熱されたウエハー 114 が下方に移動し、接合すべきチューブが相互に向かい合う状態となる。そして、第 1 クランプ (左側クランプ) 111 が第 2 クランプ側 (右クランプ側) 110 に移動し、接合すべきチューブが密着され、両者が接合される。よって、この無菌的接合装置では、第 2 クランプ (右クランプ) 110 は、常に固定台 118 に固定された状態であり、第 1 クランプ 111 は、後退、前進する前後の動きと、第 2 クランプ側に移動し、再び戻る横方向の動きの両者を行うように構成されている。つまり、1 つのクランプを、同時ではないが、相反する方向に動かすことが必要であり、そのような構造は、クランプの正確な動きを阻害するおそれがあり、クランプの動きに歪みを生じさせ、この歪みに起因するチューブの接合不良を生じることがあった。

【0005】そこで、本発明の目的は、上記の従来技術の問題点を解消し、第 1 クランプに、後退、前進する前後の動きと、第 2 クランプ側に移動し、再び戻る、横方向の動きの両者を行わせることなく、クランプの正確な動きを確保でき、クランプの動きの歪みをより少ないものとし、チューブの接合を確実に行うことができる可撓性チューブ無菌的接合装置を提供するものである。

## 【 0 0 0 6 】

【課題を解決するための手段】上記目的を達成するものは、可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも2本の可撓性チューブを平行状態にて保持する第1クランプおよび第2クランプと、該第1クランプおよび第2クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第1クランプを前記第2クランプに対して平行に移動させる第1クランプ移動機構と、前記第2クランプを前記第1クランプに対して、近接および離間する方向に移動させる第2クランプ移動機構と、前記切断手段を前記第1クランプおよび第2クランプ間にて上下動させるための切断手段駆動手段とを有する可撓性チューブ無菌的接合装置である。

【 0 0 0 7 】また、上記目的を達成するものは、可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも2本の可撓性チューブを平行状態にて、かつ押し潰すように把持する第1クランプおよび第2クランプと、該第1クランプおよび第2クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第1クランプを前記第2クランプに対して平行に移動させる第1クランプ移動機構と、前記第2クランプを前記第1クランプに対して、近接および離間する方向に移動させる第2クランプ移動機構と、前記切断手段を前記第1クランプおよび第2クランプ間にて上下動させるための切断手段駆動手段とを有し、前記第2クランプ移動機構は、前記第2クランプを前記第1クランプ側に押圧する押圧部材を有し、かつ、該押圧部材は、第1および第2クランプによりを2本の可撓性チューブを押し潰すようにして把持した時の、可撓性チューブの反発力より該押圧部材の押圧力は弱く、可撓性チューブを把持したとき、第2クランプが第1クランプより若干離間する方向に動くように構成されている無菌的接合装置である。

【 0 0 0 8 】そして、前記第1クランプ移動機構は、前記第2クランプに対して平行に移動する第1クランプ用リニアテーブルを有していることが好ましい。さらに、前記第2クランプ移動機構は、前記第1クランプに対して、近接および離間する方向に移動に移動する第2クランプ用リニアテーブルを有していることが好ましい。。

【 0 0 0 9 】そこで、本発明の可撓性チューブ無菌的接合装置について、図面を参照して説明する。この可撓性チューブ無菌的接合装置1は、少なくとも2本の可撓性チューブ48、49を平行状態にて保持する第1クランプ3および第2クランプ2と、第1クランプ3および第2クランプ2間にて可撓性チューブ48、49を切断するための切断手段5と、切断手段5により切断された可撓性チューブ48、49の接合される端部相互が向かい

合うように第1クランプ3を第2クランプ2に対して平行に移動させる第1クランプ移動機構と、第2クランプ2を第1クランプ3に対して、近接および離間する方向に移動させる第2クランプ移動機構と、切断手段5を第1クランプ3および第2クランプ間2にて上下動させるための切断手段駆動手段とを有している。さらに、この無菌的接合装置1は、第1および第2クランプ3、2として、2本の可撓性チューブ48、49を押し潰すようにして把持するものが用いられており、かつ、第2クランプ移動機構は、第2クランプ2を第1クランプ3側に押圧する押圧部材33を有し、かつ、押圧部材33は、第1および第2クランプ3、2によりを2本の可撓性チューブを押し潰すようにして把持した時の、可撓性チューブの反発力より押圧部材33の押圧力は弱く、可撓性チューブを把持したとき、第2クランプ2が第1クランプ3より若干は離間する方向に動くように構成されている。

【 0 0 1 0 】図1は、本発明の可撓性チューブ無菌的接合装置の一実施例の斜視図である。図2は、図1に示した無菌的接合装置をケースに収納した状態を示す斜視図であり、図3は、本発明の無菌的接合装置に使用される電気回路の一例を示すブロック図である。図4は、本発明の可撓性チューブ無菌的接合装置の一実施例の上面図である。この実施例の無菌的接合装置1を、図1、図2、図3、図4、第1クランプ、第2クランプおよび切断手段の動作を説明するために説明図である図6、第1クランプの動作を説明するための説明図である図7、切断手段の動作を説明するための説明図である図8、第1クランプおよび第2クランプの斜視図である図9を用いて説明する。

【 0 0 1 1 】次に、無菌的接合装置1の全体の機構について説明する。この無菌的接合装置1は、図1、図2、図4、図9に示すように、少なくとも2本の可撓性チューブを平行状態にて保持する第1クランプ3および第2クランプ2を有している。モータの作動により回転するギア30、ギア30の回転により回転するギア31、ギア31の回転により回転するシャフト32、シャフトの両端が回転可能に固定されたフレーム9、第1クランプ3の原点位置でのがたつきを防止するための防止部材11、マイクロスイッチ13、14、15、第1クランプ3を移動させるための駆動用アーム18、第1クランプ3を移動させるためのカム19、切断手段5、切断手段5および第2クランプを駆動させるためのカム17、第2クランプ2を第1クランプ側に押圧する押圧部材33、第1クランプ3の後退位置を規制する規制部材25、第1クランプ3のがたつきを防止するためのバネ部材27、ウエハー交換レバー22、ウエハーカートリッジ8、ウエハーカートリッジ交換レバー24、使用済ウエハー収納箱把持部材28、使用済ウエハーを収納箱に誘導するための誘導部材26、使用済ウエハー収納箱2

9、操作パネル50を有している。

【0012】また、図3に示すように、この実施例の無菌的接合装置1は、交流電源を直流に変換し、かつ所定の電圧の変換する整流電源回路41を有するウエハー加熱用定電圧源43と、同様にこの定電圧源43より電源が供給されるモーター42と、モーター42およびウエハー加熱制御回路44を制御するための制御器40と、可撓性チューブを加熱溶融により切断するためのウエハー6と、このウエハー6の温度検知手段7と、温度検知手段7からの信号に基づいて、定電圧源43よりウエハー6に送られる電力を制御することによりウエハー6の加熱を制御するウエハー加熱制御手段44とを有している。また、図5に示すように、定電圧源43とウエハーとを電氣的に接続するための接続端子9が設けられている。そして、ウエハー加熱制御手段44には、ウエハー短絡回路の作動の後に、装置を復帰させるためのリセットスイッチ69が電氣的に接続されており、また、ウエハー加熱制御手段44は、制御器40と電氣的に接続されている。また、制御器40には、マイクロスイッチSW1(13)、マイクロスイッチSW2(14)、マイクロスイッチSW3(15)、マイクロスイッチSW4(72)、マイクロスイッチSW5(73)、マイクロスイッチSW6(74)、入力パネル50に設けられた電源スイッチ51、開始スイッチ52、クランプリセットスイッチ53が電氣的に接続されており、さらに、制御器40より出力される信号により作動するブザー45が設けられている。モーター42は、切断手段5、第1クランプ3および第2クランプ2を駆動させる駆動源である。

【0013】そして、この無菌的接合装置1は、切断手段5により切断された可撓性チューブ48、49の接合される端部相互48a、49aが向かい合うように第1クランプ3を移動させる第1クランプ移動機構と、切断手段5をチューブ側に(上方に)移動させ、切断後再びチューブより離れる方向(下方に)に移動させるための移動機能と、第2クランプ2を第1クランプ3に対して、近接および離間する方向に移動させる第2クランプ移動機構とを有している。切断手段駆動機構には、切断手段5を2本のチューブの軸に対して垂直に上方に移動させ、チューブ切断後下方に移動させるものであり、第1クランプ移動機構は、チューブ切断後、第1クランプ3を2本のチューブの軸に対して水平状態にて直交方向(より具体的には、後方に)に移動させるものであり、第2クランプ移動機構は、第2クランプ2を第1クランプ側に近づくように、2本のチューブの軸に対して水平状態にてごくわずかに平行に移動させるものである。

【0014】そこで、第1および第2クランプ3、2について説明する。第1および第2クランプ3、2は、図1、図4、図6および図9に示すように構成されている。具体的には、第1クランプ3は、図9に示すよう

に、ベース3bと、このベース3bに回転可能に取り付けられたカバー3aと、ベース3bが固定されたクランプ固定台3cを有している。そして、このクランプ固定台3cは、リニアテーブルに固定されている。リニアテーブルは、クランプ固定台3cの下面に固定された移動台3cと、移動台3cの下部に設けられたレール部材3nにより構成されている。そして、このリニアテーブルにより、第1クランプ3は、接合するチューブ48、49の軸に対して垂直方向、言い換えれば、切断された可撓性チューブの接合される端部相互が向かい合うよう、歪みがなく移動する。よって、この実施例の無菌的接合装置1では、第1クランプ移動機構は、上記のリニアテーブル、モータ、ギア30、ギア31、シャフト32、駆動用アーム18、カム19により構成されている。そして、この接合装置1では、図1および図4に示すように、第1クランプ固定台3cの後方と、接合装置1のフレームとを接続するバネ部材27が設けられており、第1クランプ3は、常時後方に引っ張られた状態となっており、第1クランプ3(正確には、第1クランプ固定台3c)のがたつきを少ないものとしている。また、図1、図4に示すように、第1クランプ3のチューブ装着位置(言い換えれば、第1クランプが最も前に出た状態の位置)にて、第1クランプ2のがたつきを防止するための防止部材11が、フレーム9の側面に固定されている。よって、第1クランプ3は、チューブ装着位置では、バネ部材27により後方に引っ張られた状態、つまり、後方側にがたつきがない状態であり、かつ前方をがたつき防止部材により、それより前方に移動できないようになっている。よって、第1クランプ3は、チューブ装着位置では、がたつきがないように構成されている。また、接合装置1には、図1および図4に示すように、第1クランプ3(正確には、第1クランプ固定台3c)の後方の最大移動位置を規制する規制部材25が設けられている。

【0015】第2クランプ2は、図4、図6および図9に示すように、ベース2bと、このベース2bに回転可能に取り付けられたカバー2aと、ベース2bが固定されたクランプ固定台2cを有している。そして、このクランプ固定台2cは、リニアテーブルに固定されている。リニアテーブルは、クランプ固定台2cの下面に固定された移動台2cと、移動台2cの下部に設けられたレール部材2nにより構成されている。そして、このリニアテーブルにより、第2クランプ2は、接合するチューブ48、49の軸に対して平行な方向、言い換えれば、第2クランプ2を第1クランプ3に対して、近接および離間する方向にのみ、歪みがなく移動する。

【0016】また、図4および図6に示すように、接合装置1のフレームとクランプ固定台2cとの間には、押圧部材33が設けられており、常時第2クランプ2(正確には、第2クランプ固定台2c)を第1クランプ側に

押している。押圧部材としては、バネ部材が好適に使用される。そして、この押圧部材 3 3 は、第 1 および第 2 クランプ 3、2 により 2 本の可撓性チューブ 4 8、4 9 を押し潰すようにして把持した時の、可撓性チューブの反発力より押圧部材 3 3 の押圧力が弱いものが使用されており、可撓性チューブを把持したとき、第 2 クランプ 2 が第 1 クランプ 3 より若干は離間する方向に動くように構成されている。よって、この実施例の無菌的接合装置 1 では、第 2 クランプ移動機構は、上記のリニアテーブル、モータ、ギア 3 0、ギア 3 1、シャフト 3 2、カム 1 7、押圧部材 3 3 により構成されている。

【0017】そして、第 1 クランプ 3 および第 2 クランプ 2 は、図 9 に示すように、保持するチューブを斜めに押し潰した状態で保持するように構成されている。クランプ 3、2 は、ベース 3 b、2 b に旋回可能に取り付けられたカバー 3 a、2 a を有しており、ベース 3 b、2 b には、2 つのチューブを裁置するために平行に設けられた 2 つのスロット 3 f、3 e および 2 f、2 e を有している。そして、スロット 3 f、3 e とスロット 2 f、2 e が向かい合う部分のベース 3 b、2 b の端面には、鋸刃状の閉塞部材 3 h、2 h が設けられている。そして、カバー 3 a、2 a には、上記のベース 3 b、2 b の閉塞部材 3 h、2 h に対応する形状の鋸刃状の閉塞部材 3 g、2 g が設けられている。カバー 3 a、2 a の内表面は平坦となっている。そして、カバー 3 a、2 a には、それぞれ旋回カムを有しており、この旋回カムは、カバー 3 a、2 a を閉じると、ベース 3 b、2 b のローラと係合する。そして、2 本のチューブは、カバー 3 a、2 a が閉じられたとき、ベース 3 b の閉塞部材 3 h とカバー 3 a の閉塞部材 3 g との間、およびベース 2 b の閉塞部材 2 h とカバー 2 a の閉塞部材 2 g との間により、斜めに押し潰され、閉塞した状態で保持される。また、第 1 クランプ 3 は、第 2 クランプ方向に突出する突出部 3 i を有し、第 2 クランプ 2 が、この突出部 3 i を収納する凹部 2 i を有しているため、第 2 クランプ 2 は、第 1 クランプ 1 を閉塞しないと、閉塞できないように構成されている。

【0018】さらに、第 2 クランプ 2 の閉塞部材 2 g、2 h は、図 1 8 に示すように、閉塞部材 2 h f の先端および図示しないが、閉塞部材 2 g の 2 h f と向かい合う部分の先端は、閉塞部材 2 h e の先端より若干、第 1 クランプ側に突出している。このため、ウエハー 6 と閉塞部材 2 h f との距離 X 1 は、ウエハー 6 と閉塞部材 2 h e との距離 X 3 より狭くなっている。通常、この無菌的接合装置 1 では、内部に液体が充填されている使用中のチューブ 4 9 が、手前側のスロット 2 f、3 f に装着され、接合される。未使用のチューブ 4 8 は、奥側のスロット 2 e、3 e に装着される。よって、使用中のチューブが装着される側であるウエハー 6 と閉塞部材 2 h f との距離 X 1 を比較的狭いものなり、クランプ 3、2 間に

位置する把持さないチューブ 4 9 部分の長さを短いものとなる。よって、クランプ間に位置するチューブ 4 9 内の液体を少ないものとするができる。また、未使用のチューブが装着される側であるウエハー 6 と閉塞部材 2 h e との距離 X 3 を長いものとするにより、ウエハーにより溶融切断された未使用のチューブの溶けしろを多くすることができ、切断された使用中のチューブ 4 9 の左側部分との接合がより確実なものとなる。

【0019】そして、無菌的接合装置 1 は、図 1 に示すように、モータにより回転するギア 3 0 と、このギア 3 0 の回転により回転するギア 3 1 を有しており、ギア 3 1 のシャフト 3 2 には、図 6 に示すように、2 つのカム 1 9、1 7 が固定されており、カム 1 9、1 7 は、ギア 3 1 の回転と共に回転する。そして、カム 1 9 の右側面には、図 7 に示すような形状の第 1 クランプ駆動用のカム溝 1 9 a が設けられている。そして、カム 1 9 のカム溝 1 9 a 内を摺動するフォロア 1 8 a を中央部に有する第 1 クランプ移動用アーム 1 8 が設けられている。また、アーム 1 8 の下端は、支点 1 8 b によりフレーム 9 に回動可能に支持されており、アーム 1 8 の上端は、第 1 クランプ 3 のクランプ固定台 3 c に設けられた支点 1 8 c により回動可能に支持されている。よって、第 1 クランプ 3 は、リニアテーブルのレール部材 3 n に沿って、図 7 に示すように、カム 1 9 の回転により、カム溝 1 9 a の形状に従い矢印に示すように、2 本のチューブの軸に対して水平状態にて直交方向後方に移動する。

【0020】切断手段 5 は、図 5 に示すように、ウエハーを交換可能に保持するウエハー保持部 5 a と、ウエハー保持部 5 a の下方に設けられたアーム部 5 c と、アーム部 5 c の端部に設けられたフォロア 5 b と、ヒンジ部 5 d と、フレーム 9 への取付部 5 e を有している。そして、ヒンジ部 5 d によりフレーム 9 に対して旋回可能となっている。そして、図 5 に示すように、切断手段 5 の右側面には、ウエハー加熱用の電気接続端子 9、ウエハーの温度検知のための温度検知手段 7 が固定されている。温度検知手段 7 としては、熱電対または測温抵抗体であることが好ましい。より好ましくは、シース形熱電対または測温抵抗体であり、特に、シース形熱電対が好ましい。ウエハー 6 としては、向かい合うように折り曲げられた金属板と、この金属板の内面に形成された絶縁層と、この絶縁層内に上記の金属板と接触しないように形成された抵抗体と、この抵抗体の両端部に設けられた通電用端子とを有するものが好適に使用される。

【0021】そして、カム 1 7 は、図 5 および図 8 に示すように、左側面に切断手段駆動用のカム溝 1 7 a を有している。そして、切断手段 5 のフォロア 5 b は、カム 1 7 のカム溝 1 7 a 内に位置しており、カム溝 1 7 a 内をカム溝の形状に沿って摺動する。よって、切断手段 5 は、図 8 に示すように、カム 1 7 の回転により、カム溝 1 7 a の形状に従い上下に、筒い換えれば、2 本のチュ



ープの軸に対して、直交かつ垂直方向上下に移動する。さらに、カム 17 は、図 6 に示すように、中央部に第 2 クランプ 2 の駆動用のカム溝 17 c を有している。カム溝 17 c は、左側面 17 f および右側面 17 e を有しており、左側面 17 f および右側面 17 e により、第 2 クランプの位置を制御する。第 2 クランプ固定台 2 c には下方にのびる突出部を有しており、その先端にはフォロア 20 が設けられている。このフォロア 20 は、第 2 クランプ 2 の駆動用のカム溝 17 c 内を摺動する。そして、図 6 に示すように、フォロア 20 とカム溝 17 c の側面間には、若干の隙間ができるように形成されている。そして、第 2 クランプ固定台 2 c は、バネ部材 33 により常時押されているため、通常状態では、フォロア 20 は、カム溝 17 c の左側面 17 f に当接するようになり、フォロア 20 とカム溝 17 c の右側面 17 e との間に若干の隙間ができる。しかし、第 1 および第 2 クランプ 3, 2 により 2 本のチューブを保持すると、上述のように、2 つのクランプ 3, 2 はそれぞれ、2 本のチューブを押し潰すように閉塞し保持するため、チューブの閉塞に起因する反発力が生ずる。そして、バネ部材 33 は、上記チューブの閉塞に起因する反発力より小さい力のものが用いられているため、クランプ 3, 2 がチューブを保持する状態では、図 6 に示すように、フォロア 20 は、カム溝 17 c の右側面 17 e に当接するようになり、フォロア 20 とカム溝 17 c の左側面 17 f との間に若干の隙間ができる。しかし、上述の切断手段 5 によりチューブが切断されと、チューブの閉塞に起因する反発力が消失するため、通常状態に戻り、フォロア 20 は、カム溝 17 c の左側面 17 f に当接するようになり、フォロア 20 とカム溝 17 c の右側面 17 e との間に若干の隙間ができる。このように、バネ部材 33 の作用およびチューブの反発力により、フォロア 20 が当接するカム溝の摺動面が経時的に変化するように構成されている。

【0022】そして、図 6 に示すように、左側面 17 f に凹部 17 d が形成されている。この凹部 17 d 部分をフォロア 20 が通過する時期は、切断手段によりチューブの切断後であるため、フォロア 20 は、カム溝 17 の左側面 17 f を沿って摺動している状態であり、よって、フォロア 20 は凹部 17 部分に入る。このため、凹部 17 d の深さ分だけ、第 2 クランプ 2 が第 1 クランプ 3 方向に移動することになる。これにより、チューブの接合がより確実となる。そして、カム溝 17 c の右側面 17 e にも凹部 17 g が設けられている。この凹部 17 g は、クランプ 3, 2 の内面の清掃のためのものである。この凹部 17 g を設けることにより、第 2 クランプ 2 をバネ部材 33 側に押すことにより、フォロア 20 が凹部 17 g に当接するまで、第 2 クランプ 2 を第 1 クランプ 3 より離間する方向に移動することができ、これにより、第 1 クランプ 3 と第 2 クランプとの間に隙間が形

成される。形成された隙間内に清掃部材、例えば、アルコールなどのある程度切断されるチューブの形成材料を溶解できる溶剤を含有した綿棒により清掃することが可能となる。この凹部 17 g は、図 6 に示すように、左側面 17 f の凹部 17 d (第 2 クランプ 2 の幅寄せが行われる部分) とほぼ向かい合う位置に設けられている。第 2 クランプ固定台 2 c の下方にのびる突出部に設けられたフォロア 20 が凹部 17 d 部分に入っているときは、チューブ切断後、目的とするチューブ相互を接合した状態であり、この状態にて、第 2 クランプは停止する。また、第 1 クランプも既に停止しており、かつ、第 1 クランプ 3 は、第 2 クランプとずれた位置にある。具体的には、図 1 に示すように、第 1 クランプ 3 が、第 2 クランプ 2 より後退しており、第 1 クランプ 3 は、第 2 クランプとずれた位置にある。このため、この状態では、第 2 クランプ 2 の先端部の内面が若干露出しており、さらに、第 1 クランプの後端部の内面も若干露出している。よって、露出した第 2 クランプ 2 の内面および第 1 クランプ 3 は、その清掃が容易である。

【0023】次に、本発明の無菌的接合装置 1 の作用を図面を用いて説明する。図 10 は、切断手段、第 1 クランプ、第 2 クランプの動作を示すタイミングチャートである。図 11, 図 12 および図 13 は、無菌的接合装置の作用を説明するためのフローチャートである。図 14、図 15、図 16 および図 17 は、無菌的接合装置の作用を説明するための説明図である。図 18 は、無菌的接合装置 1 の第 1 および第 2 クランプの動き、およびチューブの把持状態を説明するための説明図である。この接合装置 1 では、接合作業終了時の第 1 クランプ 3 は、第 2 クランプ 2 とずれた位置となっており、図 10 のタイミングチャートの停止位置にある。図 10 のタイミングチャートの横軸の角度は、原点 (第 1 クランプと第 2 クランプの位置があっている状態) を  $0^{\circ}$  とし、その後のギア 31 のシャフト 32 の回転角度、言い換えれば、カム 17 およびカム 19 の回転角度のときの、切断手段 (ウエハー)、第 1 クランプ 3、第 2 クランプ 2 の動きを示すものである。

【0024】まず、最初にフローチャートの図 11 に示すように、図 3 のパネル 50 に設けられている電源スイッチ 51 を押す。これにより、図 3 に示す制御器 40 を構成する CPU により、接合装置 1 は、異常が無い (具体的には、内部コネクタの抜けがないか、熱電対の断線がないか、内部定電圧源に不良がないか) を判断し、以上がある場合は、ブザーが鳴動する。続いて、図 3 のパネル 50 に設けられているクランプリセットスイッチ 53 を押す。CPU により、第 1 および第 2 クランプが開いているか否か、第 1 および第 2 クランプが原点にないか否か、ウエハー交換レバーが原点にあるか否かを判断する。なお、この実施例の無菌的接合装置 1 で使用するクランプは、上述のように、第 1 クランプ 3 が、

第 2 クランプ方向に突出する突出部 3 i を有し、第 2 クランプ 2 が、この突出部 3 i を収納する凹部 2 i を有しているため、第 2 クランプ 2 は、第 1 クランプ 1 を閉塞しないと、閉塞できないように構成されている。このため、第 1 および第 2 クランプが開いていることは、第 2 クランプが閉塞されたときに、接触するレバー 1 6 と、このレバー 1 6 により ON/OFF されるマイクロスイッチ 1 3 により検知される。具体的には、マイクロスイッチ 1 3 は、第 2 クランプが解放状態のときは、OFF となっており、第 2 クランプ 2 が閉塞されたときにレバー 1 6 と接触し、レバー 1 6 が動きマイクロスイッチ 1 3 を ON 状態とする。このマイクロスイッチ 1 3 の ON/OFF 信号は、制御器 4 0 に入力される。第 1 および第 2 クランプが原点にないことは、それぞれのカムの円周上に設けられた溝をマイクロスイッチ SW5 (7 3)、SW6 (7 4) が検知することにより判断される。ウエハー交換レバー 2 2 が原点にあることは、マイクロスイッチ 1 4 により検知される。レバー 2 2 が、原点にある場合は、マイクロスイッチ 1 4 が ON となり、原点にない場合は、OFF となり、このマイクロスイッチ 1 4 の ON/OFF 信号は、制御器 4 0 に入力される。

【0025】そして、図 11 に示すように、上述の 4 つの点すべてが YES の場合、モータを作動させ、第 1 および第 2 クランプを原点に復帰させる。また、上述の 4 つの点のうちいずれか 1 つでも NO の場合、ブザーが鳴動し、異常ランプが点灯し、手動解除を行い、リセットスイッチを押すことにより、異常ランプが消灯する。第 1 および第 2 クランプが原点に到達した後、2 本の可撓性チューブ 4 8、4 9 を第 1 および第 2 クランプに装着する。この状態での第 1 および第 2 クランプ 3、2 は、図 9 に示すように、両者とも開放した状態であり、かつ両者に設けられたスロット 3 e と 2 e および 3 f と 2 f は互いに向かいあった状態となっている。そして、使用中のチューブ 4 9 を手前側のスロット 3 f、2 f に装着し、接続される未使用のチューブ 4 8 を奥側のスロット 3 e、2 e に装着する。

【0026】そして、上記のように第 1 および第 2 クランプ 3 を閉塞した後、ウエハー交換レバー 2 2 をクランプ側に押して、ウエハーを交換する。ウエハー交換レバー 2 2 をクランプ側に押すことにより、ウエハーカートリッジ 8 内より、新しいウエハーが取り出され、新しいウエハーが、切断手段 5 に装着されている待機ウエハーを押し、待機ウエハーが切断手段 5 に装着されていた使用済ウエハーを押し、待機ウエハーが使用位置に装着されるとともに、使用済ウエハーは、使用済ウエハー収納箱 2 9 内に収納される。続いて、パネル 5 0 の開始スイッチ 5 2 を押すと図 12 のフローチャートの ②に移行し、図 3 に示す制御器 4 0 を構成する CPU により、第 1 および第 2 クランプが閉じているか否か、ウエハーが交換済であるか否か、第 1 および第 2 クランプが原点に

あるか否か、ウエハー交換レバーが原点にあるか否か、第 1 および第 2 クランプが閉じているか否かは、第 2 クランプが閉塞されたときに、接触するレバー 1 6 と、このレバー 1 6 により ON/OFF されるマイクロスイッチ 1 3 により検知される。具体的には、マイクロスイッチ 1 3 は、第 2 クランプが解放状態のときは、OFF となっており、第 2 クランプ 2 が閉塞されたときにレバー 1 6 と接触し、レバー 1 6 が動き、マイクロスイッチ 1 3 を ON 状態とする。このマイクロスイッチ 1 3 の ON/OFF 信号は、制御器 4 0 に入力される。ウエハーが交換済であるか否かは、ウエハー交換レバー 2 2 をクランプ方向に押し、ウエハー交換作業を行うと、交換レバー 2 2 は、マイクロスイッチ 1 5 を一度 ON させるので、マイクロスイッチ 1 5 からの ON 信号により交換されたか否か検知される。マイクロスイッチ 1 5 の ON/OFF 信号は、制御器 4 0 に入力される。第 1 および第 2 クランプが原点にあるか否かは、上述のようにマイクロスイッチ 5、6 により検知する。

【0027】そして、図 12 に示すように、上述の 4 つの点のいずれか 1 つでも NO の場合、ブザーが鳴動し、図 11 の ③にもどる。また、上述の 4 つの点のすべてが YES の場合、動作中ランプ 4 7 が点灯し、ウエハーの加熱が開始される。ウエハーの加熱開始後、ウエハー電流が設定値以上であるか判断し、これは、ウエハーが短絡しているかを判断するためである。そして、ウエハー電流が設定値以下（シャント抵抗にかかる電圧が所定値以上）でない場合は、0.3 秒待った後に、ウエハー電流が設定値範囲内であるか判断する。これは、ウエハーが使用済のものである場合、抵抗体の熱履歴のために、抵抗値が低下するため、ウエハー電流を測定し、あらかじめ設定したウエハー電流と比較し、設定範囲内（許容範囲内）であるかを検知し、これにより、ウエハーが使用済であるかを電氣的に判断する。上記のウエハー電流が設定値以上である場合（ウエハーが短絡している場合）および、上述のウエハー電流が設定範囲内でない場合（ウエハーが使用済みの場合）は、ブザーが鳴動し、ウエハーの加熱を停止し、ウエハー異常ランプが点灯し、リセットスイッチが押された後、図 11 のフローチャート ⑤に移行する。そして、ウエハー電流と比較し、設定範囲内（許容範囲内）である場合は、ウエハーの加熱が継続される。ウエハー 6 の加熱は、ウエハー温度検知手段である熱電対 7 の温度検知出力に基づいて、算出されるパルス幅変調信号により定電圧源 4 3 を制御しながら行われる。そして、ウエハーの過剰加熱を防止するために、ウエハーの加熱時間が所定時間内であるか判断し、また、ウエハー電流が所定値以下であるか判断し、所定値以下、つまりウエハーが短絡事故を起こしている場合は、直ちにブザーが鳴動し、ウエハーの加熱を停止し、図 11 のフローチャート ⑤に移行する。そして、ウエハーの温度が設定温度に達すると、図 13 のフローチャート

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ャート④に移行し、モータが作動し、これにより、ギア 30、ギア 31、カム 19、17 が回転し、切断手段（ウエハー）の上昇し、チューブの切断、第 1 クランプの後退、切断手段（ウエハー）の下降、第 2 クランプの第 1 クランプ側への幅寄せが行われる。

【0028】そして、図 13 のフローチャートに示すように、ウエハーの上昇、チューブの切断、第 1 クランプの後退、ウエハーの下降がそれぞれの順序で行われる。具体的に説明すると、まず、カム 17 が矢印方向に回転することにより、切断手段 5 のフォロア 5 b は、カム溝 17 a 内を摺動をする。当初図 8 および図 10 に示すカム溝の原点 O がフォロア 5 b と接触していた状態より、図 8 および図 10 に示すカム溝 17 a の点 A がフォロア 5 b と接触するようになる。そして、図 8 および図 10 に示すカム溝 17 a の点 A がフォロア 5 b と接触する状態から、カム溝 17 a の点 B がフォロア 5 b と接触する状態に至るまでの間、図 10 に示すように、なだらかに切断手段 5 は上昇し、この間において、2 本の可撓性チューブが切断される。図 14 および図 15 を用いて説明すると、2 本のチューブ 48、49 は、第 1 クランプ 3 および第 2 クランプ 2 により保持されており、第 1 クランプ 3 および第 2 クランプ 2 の間に位置するチューブ部分 48 a、49 a が形成され、その下方に切断手段のウエハー 6 が位置している。そして、上述のように、カム 17 の回転により、切断手段 5（ウエハー 6）が上昇することにより、図 15 に示すように、2 本のチューブの第 1 クランプ 3 および第 2 クランプ 2 の間に位置するチューブ部分 48 a、49 a にて両者を溶融切断する。

【0029】そして、図 8 に示すカム溝 17 a の点 B がフォロア 5 b と接触する状態から、カム溝 17 a の点 C がフォロア 5 b と接触する状態に至るまでの間、図 8 および図 10 に示すように、切断手段 5 は、上昇した状態が維持され、チューブ 48 a、49 a の切断された端部を十分に溶解する。そして、図 8 および図 10 に示すカム溝 17 a の点 C がフォロア 5 b と接触する状態から、カム溝 17 a の点 E がフォロア 5 b と接触する状態に至るまでの間、図 8 および図 10 に示すように、なだらかに切断手段 5 は下降する。また、図 7 に示すように、カム 19 が矢印方向に回転することにより、第 1 クランプを移動させるためのアーム 18 に設けられたフォロア 18 a は、カム溝 19 a 内を摺動をする。当初図 7 および図 10 に示すカム溝の原点 O がフォロア 18 a と接触していた状態より、図 7 および図 10 に示すカム溝 19 a の点 F がフォロア 18 a と接触するようになる。図 10 のタイミングチャートに示すように、切断手段 5 のフォロア 5 b がカム溝 17 a の点 B に至るより若干早く、フォロア 18 a は、カム溝 19 a 点 F に至る。そして、図 7 および図 10 に示すように、カム溝 19 a の点 F がフォロア 18 a と接触する状態から、カム溝 19 a の点 G がフォロア 18 a と接触する状態に至るまでの間、図 1

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0 に示すように、徐々に第 1 クランプ 3 は後退し、図 16 に示す状態となり、接合されるチューブ部分 49 a と 48 a がウエハー 6 を介して向かい合った状態となる。この状態は、図 10 のタイミングチャートに示すように、カム溝 19 a の点 G がフォロア 18 a と接触する状態から、カム溝 17 a の点 C がフォロア 5 b と接触する状態に至るまでの間維持される。そして、第 1 クランプの位置は、点 G がフォロア 18 a と接触する状態から、カム溝 19 a の点 H がフォロア 18 a と接触する状態に至るまでの間、図 16 の状態が維持される。なお、切断手段 5 は、上述のように、図 8 および図 10 に示すカム溝 17 a の点 C がフォロア 5 b と接触する状態から、カム溝 17 a の点 E がフォロア 5 b と接触する状態に至るまでの間、図 8 および図 10 に示すように、なだらかに下降し、接合されるチューブ部分 48 a、49 a が当接する。

【0030】そして、切断手段 5 の下降が終了した状態、言い換えれば、カム溝 17 a の点 E がフォロア 5 b と接触する状態に至ったときとほぼ同時に、図 6 および図 10 に示すように、第 2 クランプ 2 が、第 1 クランプ側に幅寄せを行う。具体的には、図 6 および図 10 に示すように、カム溝 17 c の左側面 17 d の点 M が、第 2 クランプ 2 を駆動させるためのフォロア 20 と接触する状態から、左側面の点 L がフォロア 20 と接触する状態に至るまでの間、徐々に、第 2 クランプ 2 は、第 1 クランプ 3 側に移動し、カム溝 17 c の凹部 17 d の点 L K が、フォロア 20 と接触する状態から、凹部 17 d の点 K がフォロア 20 と接触する状態に至るまでの間、幅寄せした状態を維持する。この幅寄せにより、チューブ部分 48 a、49 a の両者は確実に密着するので、両者の接合をより確実なものにすることができる。そして、カム溝 17 c の凹部 17 d の点 K が、フォロア 20 と接触する状態から、左側面 17 f の点 J がフォロア 20 と接触する状態に至るまでの間、徐々に、第 2 クランプ 2 は、第 1 クランプ 3 側より離れる方向に移動し、この状態にて、モータの作動が停止する。

【0031】よって、停止した位置での、第 1 クランプ 3 は、第 2 クランプ 2 の位置は、図 17 に示すように、図 16 と同様にずれた位置となっている。そして、図 13 のフローチャートに示すように、熱電対によりウエハー温度が検知され、ウエハー温度が設定値以下になると、動作ランプが消灯し、ブザーが鳴動する。そして、図 17 に示すように、第 1 クランプ 2 および第 2 クランプ 3 を開き、チューブを取り出すことにより、チューブの接合作業が終了する。

【0032】従来の無菌的接合装置では、第 1 クランプ および第 2 クランプは、2 本のチューブを押し潰すようにして把持するように構成されている。そして、図 18 の（A-1）に示すように、第 1 クランプ 3 の前方部分は、ウエハー 6 と距離 X 2 離間しており、また、第 2 ク

ランプ2は、ウエハー6と距離X1離間している。第1および第2クランプ3、2の両者が完全に固定した状態では、押し潰された2本のチューブの第1および第2クランプ間の部分は、図18の(A-2)に示すように、膨らんだ状態となり後に行われれるチューブの接合に支障を来すことになる。このため、図18の(A-2)に示すように、従来の接合装置では、第2クランプ2(右クランプ)が固定されているので、第1クランプ3(左クランプ)を2本のチューブを押し潰すようにして把持した時の、チューブの反発力に押されて、第1クランプが第2クランプより若干は離れる方向に動くように構成されている。これにより、第1クランプ3は、ウエハー6と距離( $X2 + \Delta x$ )離間する。また、チューブの反発力が消失した後、つまり、ウエハーによりチューブが切断された後は、図18の(A-3)に示すように、再び第2クランプ側に近づく方向に動くように、第1クランプを第2クランプ側に押圧するバネが設けられている。

【0033】また、この種の接合装置では、クランプの手前側のスリットに液体が充填された使用中のチューブ49を装着し、クランプの奥側のスリットに未使用の接続用チューブ48を装着して、両者の接合を行う。しかし、従来の接合装置では、図13の(A-2)に示すように、第1クランプ3が、チューブ48、49を把持したことにより左側に移動するため、ウエハー6は、第1クランプ3と第1クランプ2間に挟まれ、若干膨らんだ部分の右側を切断することになる。使用中チューブの第1クランプ3と第1クランプ2間に挟まれ、若干膨らんだ部分の内部には、液体が存在していることが多く、その右側を切断すると、図13の(A-3)に示すように、存在していた液体がウエハー表面に残り、これに起因して、チューブの接合不良が生じることがある。しかし、本発明の無菌的接合装置1では、接合されるチューブの第1クランプ側の端面をよりきれいな端面とし、チューブの接合を確実に行うことができる。

【0034】具体的に説明すると、従来の無菌的接合装置では、図18の(A-2)に示すように、チューブを把持することにより、その反発力により第2クランプより離れる方向に動いた第1クランプは、加熱されたウエハーによりチューブが溶融切断されることにより、図18の(A-3)に示すように、再び第2クランプ側に移動する。よって、図18の(A-3)段階では、第1クランプの第2クランプ側への移動距離( $\Delta x$ )に相当する長さ分のチューブ材料および内容物が、ウエハー表面(ウエハーの第2クランプ側表面)に溶融し付着することになる。そして、図18の(A-4)に示すように、第1クランプは、チューブの接合のために後方に移動される。このとき、ウエハー表面に付着した溶融樹脂および内容物を引きずるように移動するため、接合されるチューブの第1クランプ側の端面がきれいな端面となりに

く、これに起因して、ウエハーが下方に移動し、接合されるチューブ相互が密着された後に形成されるチューブの接合部分にチューブ接合不良を生じることがある。

【0035】本発明の無菌的接合装置1は、従来の接合装置と同様に、第1クランプおよび第2クランプは、2本のチューブを押し潰すようにして把持するように構成されている。そして、図18の(B-1)に示すように、第1クランプ3の前方部分は、ウエハー6と距離X1離間しており、また、第2クランプ2は、ウエハー6と距離X2離間している。そして、図18の左側の(B-2)に示すように、第1クランプ3(左クランプ)を2本のチューブを押し潰すようにして把持した時の、チューブの反発力に押されて、第2クランプが第1クランプより若干は離れる方向に動くように構成されており、これにより、第2クランプ2は、ウエハー6と距離( $X1 + \Delta x$ )離間する。また、チューブの反発力が消失した後、つまり、ウエハーによりチューブが切断された後は、図18の(B-3)に示すように、第2クランプ2は、バネ部材23により押され、再び第1クランプ3側に近づく方向に移動する。

【0036】よって、本発明の接合装置1では、図13の(B-2)に示すように、クランプ3、2が、チューブ48、49を把持したことにより、第2クランプが右側に移動するため、ウエハー6は、第1クランプ3と第1クランプ2間に挟まれ、若干膨らんだ部分の左側を切断することになる。使用中チューブ49の第1クランプ3と第1クランプ2間に挟まれ、若干膨らんだ部分の内部には、液体が存在していることが多い。しかし、左側を切断するので、存在していた液体がウエハー表面に残ることがなく、ウエハー表面に残った液体に起因するチューブの接合不良を防止することができる。

【0037】さらに、本発明の接合装置1では、第2クランプ2は、加熱されたウエハーによりチューブが溶融切断されることにより、図18の(B-3)に示すように、再び第2クランプは、第1クランプ側に移動する。よって、図18の(B-3)段階では、第2クランプの第1クランプ側への移動距離( $\Delta x$ )に相当する長さ分のチューブ材料が、ウエハー表面(ウエハーの第2クランプ側表面)に溶融し付着することになる。そして、図18の(B-4)に示すように、第1クランプは、チューブの接合のために後方に移動される。このとき、ウエハーの第1クランプ側表面には、第2クランプ側表面に比べて、溶融した樹脂および内容物の付着が少ないので、ウエハー表面に付着した溶融樹脂および内容物を引きずるように移動することが少なく、接合されるチューブの第1クランプ側の端面がきれいなものとすることができる。また、溶融樹脂を多く付着しているウエハーの第2クランプ側表面では、チューブの移動が行われないので、接合されるチューブの第2クランプ側の端面もきれいなものとすることができる。よって、接合されるチ

ューブ相互が密着された後に形成されるチューブの接合部分にチューブ接合不良を生じることが少ない。

【0038】

【発明の効果】本発明の無菌的接合装置は、可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも2本の可撓性チューブを平行状態にて保持する第1クランプおよび第2クランプと、該第1クランプおよび第2クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第1クランプを前記第2クランプに対して平行に移動させる第1クランプ移動機構と、前記第2クランプを前記第1クランプに対して、近接および離間する方向に移動させる第2クランプ移動機構と、前記切断手段を前記第1クランプおよび第2クランプ間にて上下動させるための切断手段駆動手段とを有するので、第1クランプは、後退、前進の前後の動きのみ行い、第2クランプは、第1クランプ側に近接、離間する動きのみを行うので、それぞれのクランプの正確な動きを確保でき、クランプの動きの歪みをより少ないものとし、チューブの接合を確実に行うことができる。

【0039】また、本発明の可撓性チューブ無菌的接合装置は、可撓性チューブを無菌的に接合するための装置であって、該装置は、少なくとも2本の可撓性チューブを平行状態にて、かつ押し潰すように把持する第1クランプおよび第2クランプと、該第1クランプおよび第2クランプ間にて前記可撓性チューブを切断するための切断手段と、該切断手段により切断された可撓性チューブの接合される端部相互が向かい合うように前記第1クランプを前記第2クランプに対して平行に移動させる第1クランプ移動機構と、前記第2クランプを前記第1クランプに対して、近接および離間する方向に移動させる第2クランプ移動機構と、前記切断手段を前記第1クランプおよび第2クランプ間にて上下動させるための切断手段駆動手段とを有し、前記第2クランプ移動機構は、前記第2クランプを前記第1クランプ側に押圧する押圧部材を有し、かつ、該押圧部材は、第1および第2クランプにより2本の可撓性チューブを押し潰すようにして把持した時の、可撓性チューブの反発力より該押圧部材の押圧力は弱く、可撓性チューブを把持したとき、第2クランプが第1クランプより若干離間する方向に動くように構成されているので、上記のように、第1クランプは、後退、前進の前後の動きのみ行い、第2クランプは、第1クランプ側に近接、離間する動きのみを行うので、それぞれのクランプの正確な動きを確保でき、クランプの動きの歪みをより少ないものとし、チューブの接合を確実に行うことができる。さらに、本発明の接合装置では、チューブの接合のために後方に移動され側のウエハーの表面（第1クランプ側のウエハー表面）には、その反対側のウエハー表面（第2クランプ側のウエハー

表面）に比べて、溶融した樹脂および内容物の付着が少ないので、ウエハー表面に付着した溶融樹脂および内容物を引きずるように移動することが少なく、接合されるチューブの第1クランプ側の端面がきれいなものとしてことができ、接合されるチューブ相互が密着された後に形成されるチューブの接合部分にチューブ接合不良を生じることが少ない。

【図面の簡単な説明】

【図1】図1は、本発明の可撓性チューブ無菌的接合装置の一実施例の斜視図である。

【図2】図2は、図1に示した無菌的接合装置をケースに収納した状態を示す斜視図である。

【図3】図3は、本発明の無菌的接合装置に使用される電気回路の一例を示すブロック図である。

【図4】図4は、本発明の可撓性チューブ無菌的接合装置の一実施例の上面図である。

【図5】図5は、本発明の接合装置に使用される切断手段の一例を示す左側面図である。

【図6】図6は、第1クランプ、第2クランプおよび切断手段の動作を説明するために説明図である。

【図7】図7は、第1クランプの動作を説明するための説明図である。

【図8】図8は、切断手段の動作を説明するための説明図である。

【図9】図9は、本発明の無菌的接合装置に使用される第1および第2クランプの一例を示す斜視図である。

【図10】図10は、第1クランプ、第2クランプおよび切断手段の動作タイミングを示すタイミングチャートである。

【図11】図11は、本発明の無菌的接合装置の作用を説明するためのフローチャートである。

【図12】図12は、本発明の無菌的接合装置の作用を説明するためのフローチャートである。

【図13】図13は、本発明の無菌的接合装置の作用を説明するためのフローチャートである。

【図14】図14は、本発明の無菌的接合装置の作用を説明するための説明図である。

【図15】図15は、本発明の無菌的接合装置の作用を説明するための説明図である。

【図16】図16は、本発明の無菌的接合装置の作用を説明するための説明図である。

【図17】図17は、本発明の無菌的接合装置の作用を説明するための説明図である。

【図18】図18は、無菌的接合装置の第1および第2クランプの動き、およびチューブの把持状態を説明するための説明図である。

【図19】図19は、従来の可撓性チューブ無菌的接合装置の斜視図である。

【符号の説明】

1 無菌的接合装置

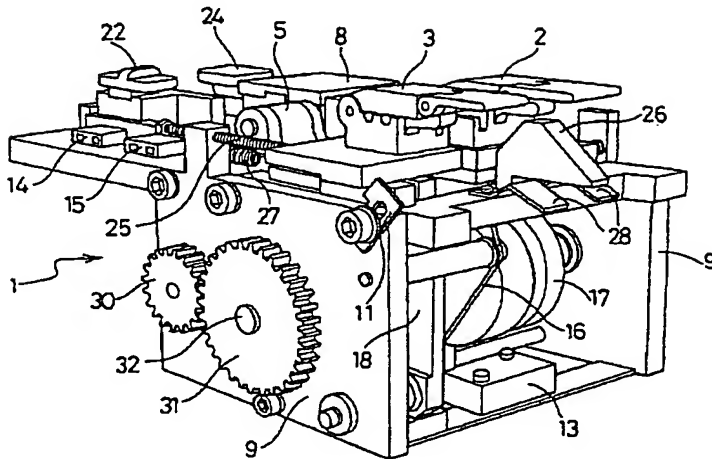
19

20

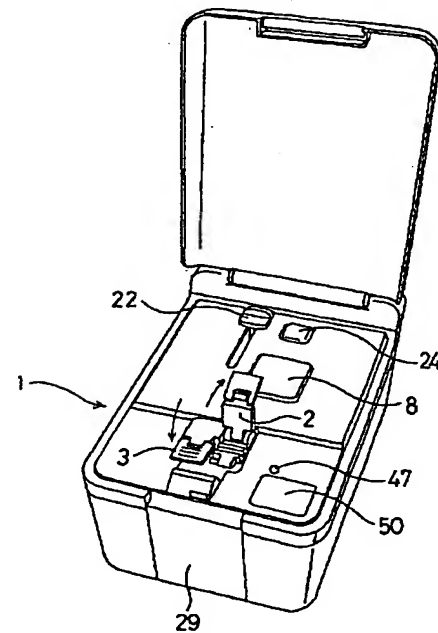
- 2 第2クランプ
- 3 第1クランプ
- 3 d リニアテーブルの移動台
- 3 h リニアテーブルのレール部材
- 3 3 押圧部材
- 5 切断手段
- 6 ウエハー
- 7 ウエハー温度検知手段
- 9 ウエハー加熱用の電気接続端子
- 1 3 マイクロスイッチ 1

- 1 4 マイクロスイッチ 2
- 1 5 マイクロスイッチ 3
- 4 8 チューブ
- 4 9 チューブ
- 4 0 制御器
- 4 1 整流電源回路
- 4 2 モーター
- 4 3 定電圧源
- 4 4 ウエハー加熱制御手段
- 10 5 0 入力パネル

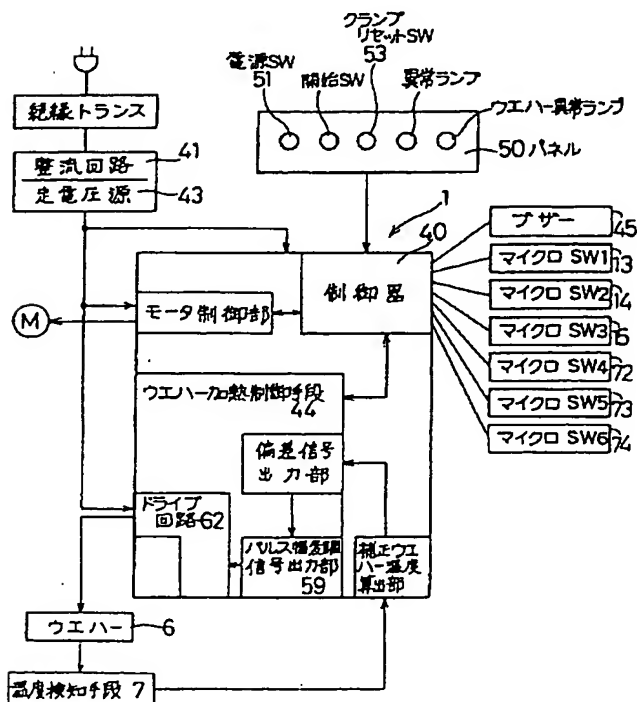
【図1】



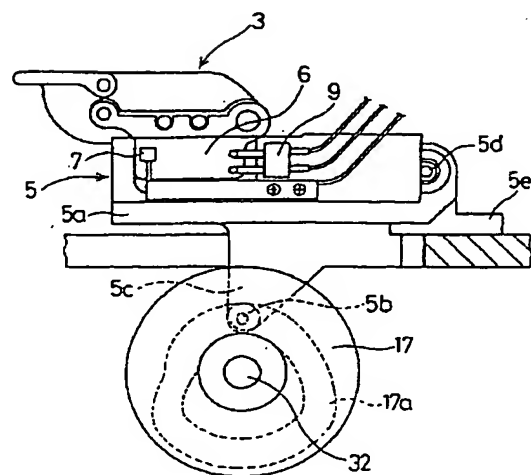
【図2】



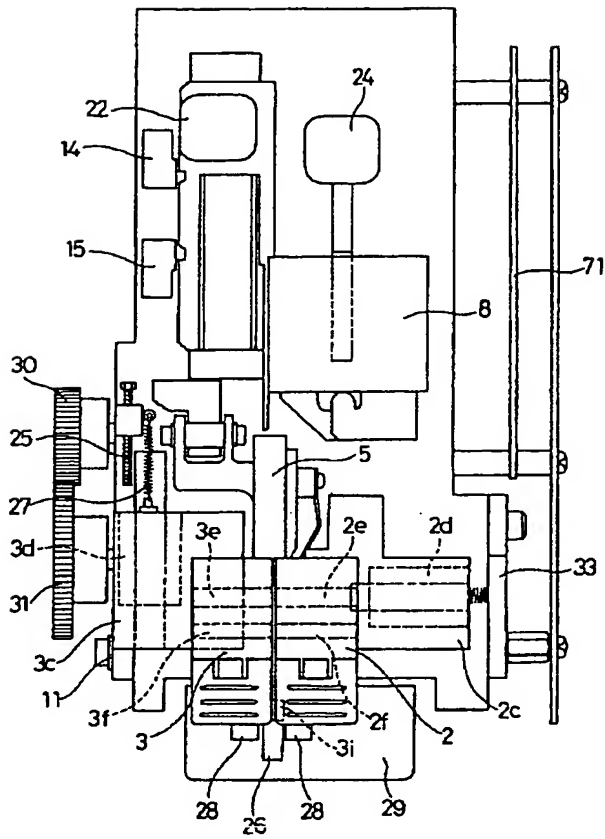
【図3】



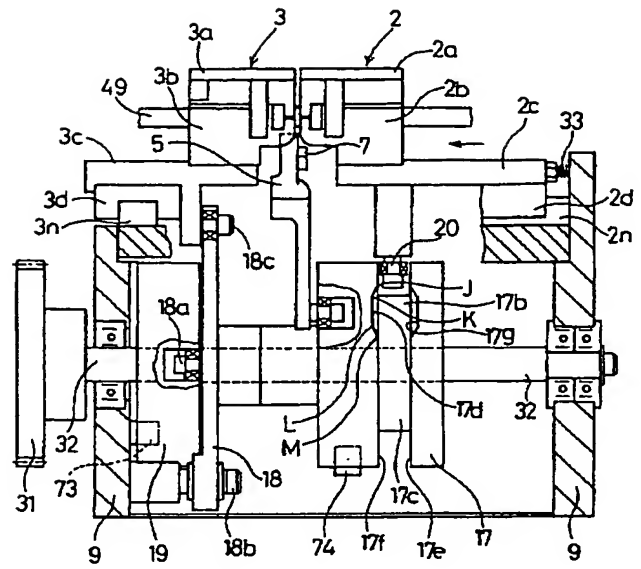
【図5】



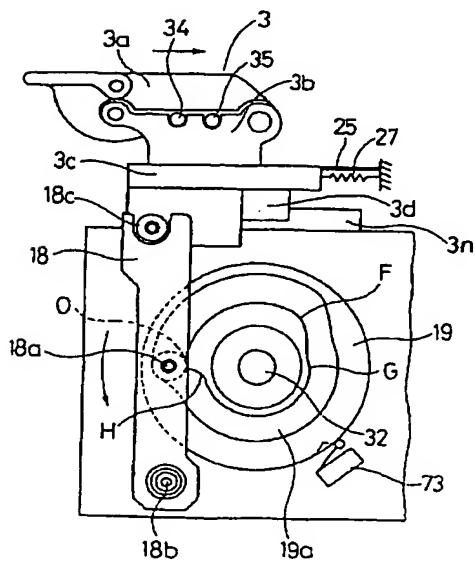
【図 4】



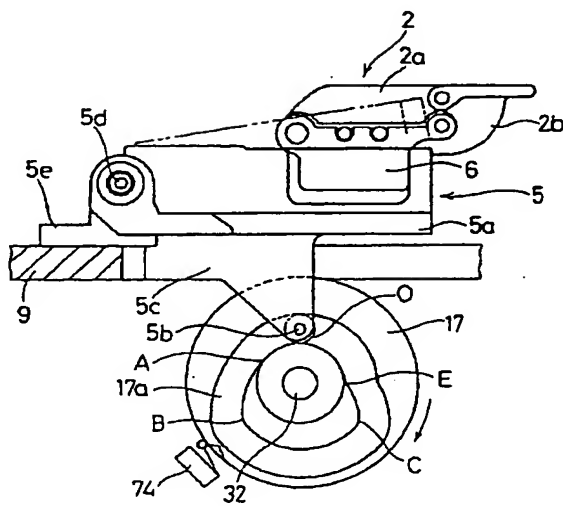
【図 6】



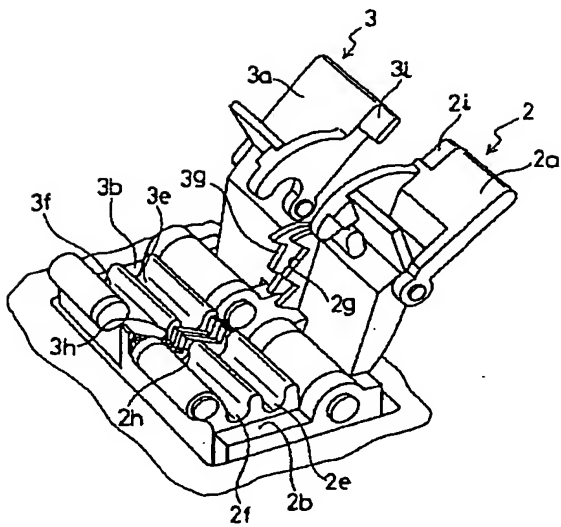
【図 7】



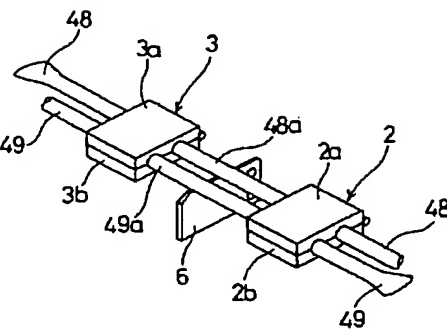
【図 8】



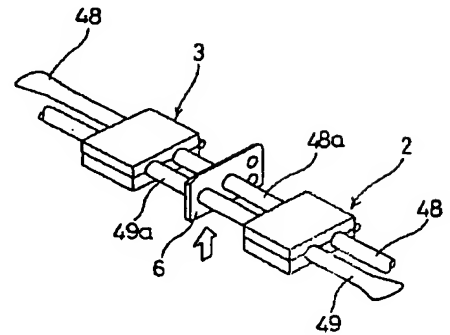
【図9】



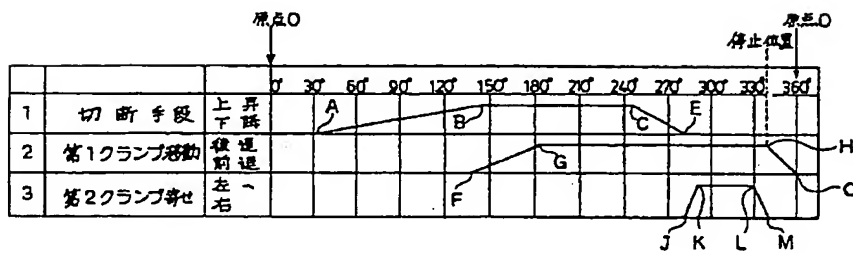
【図14】



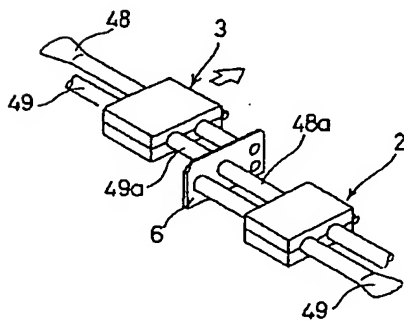
【図15】



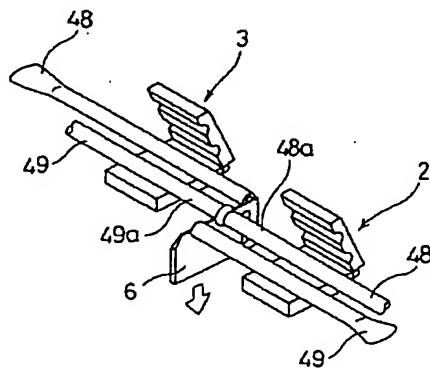
【図10】



【図16】

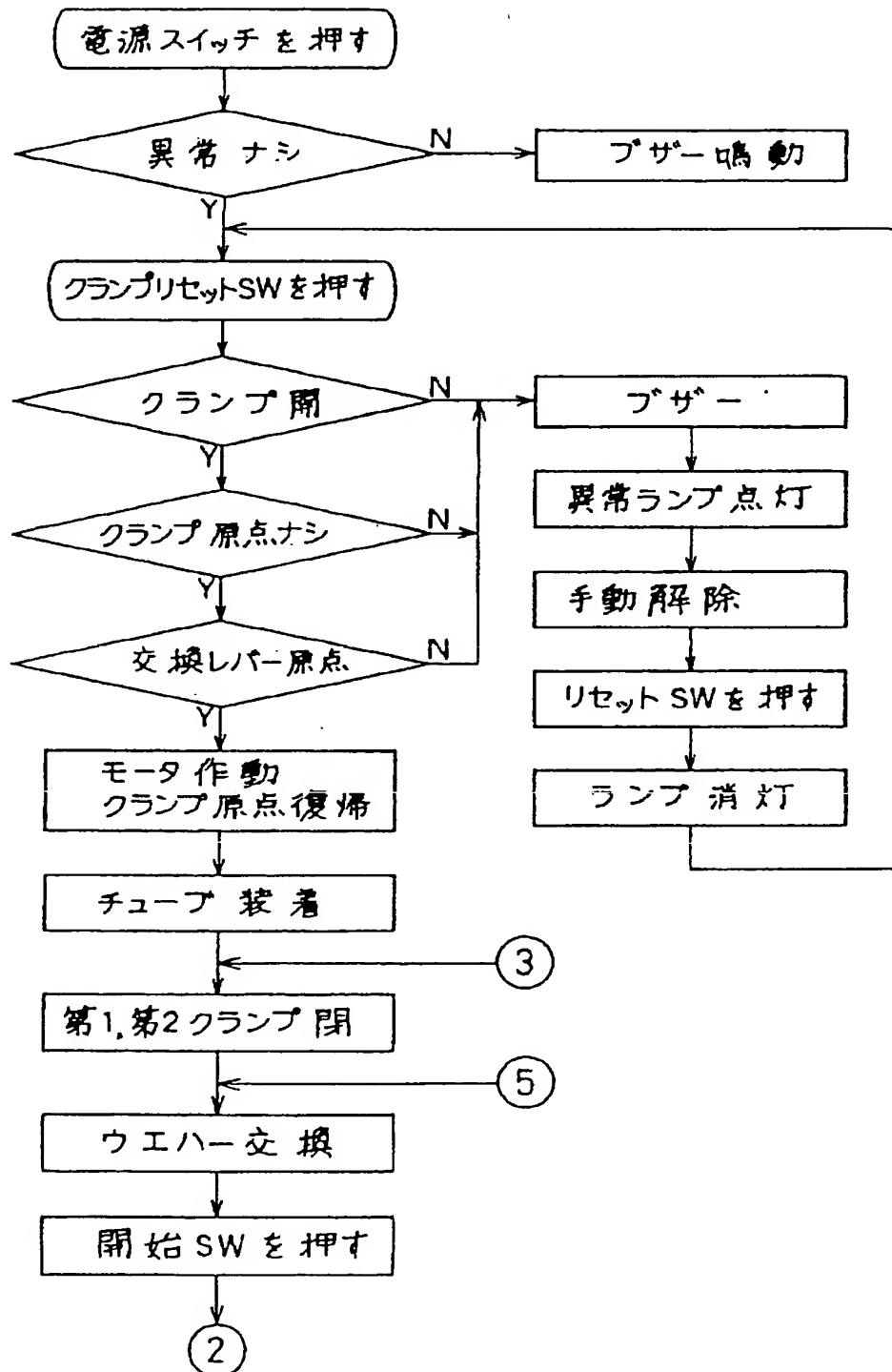


【図17】

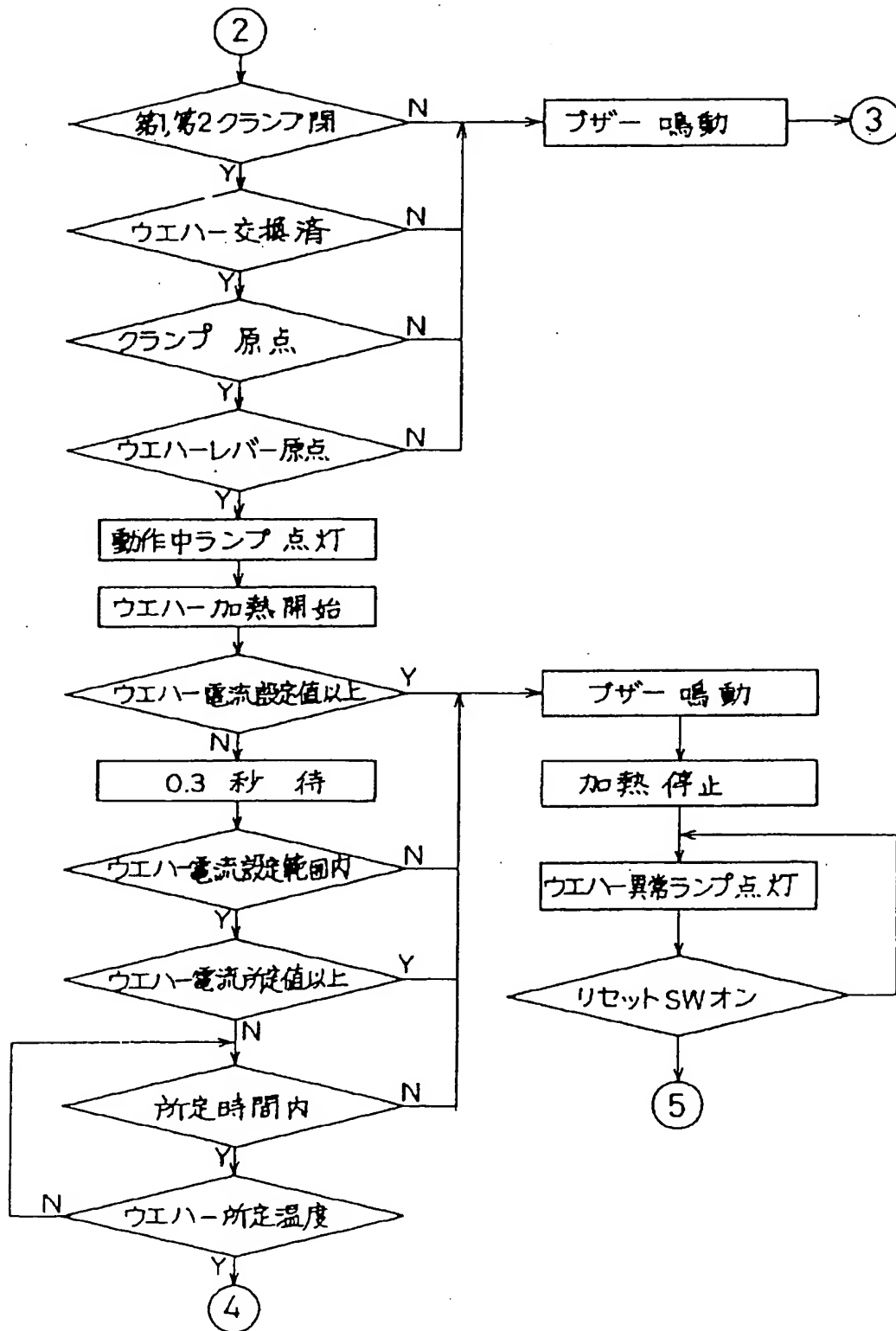




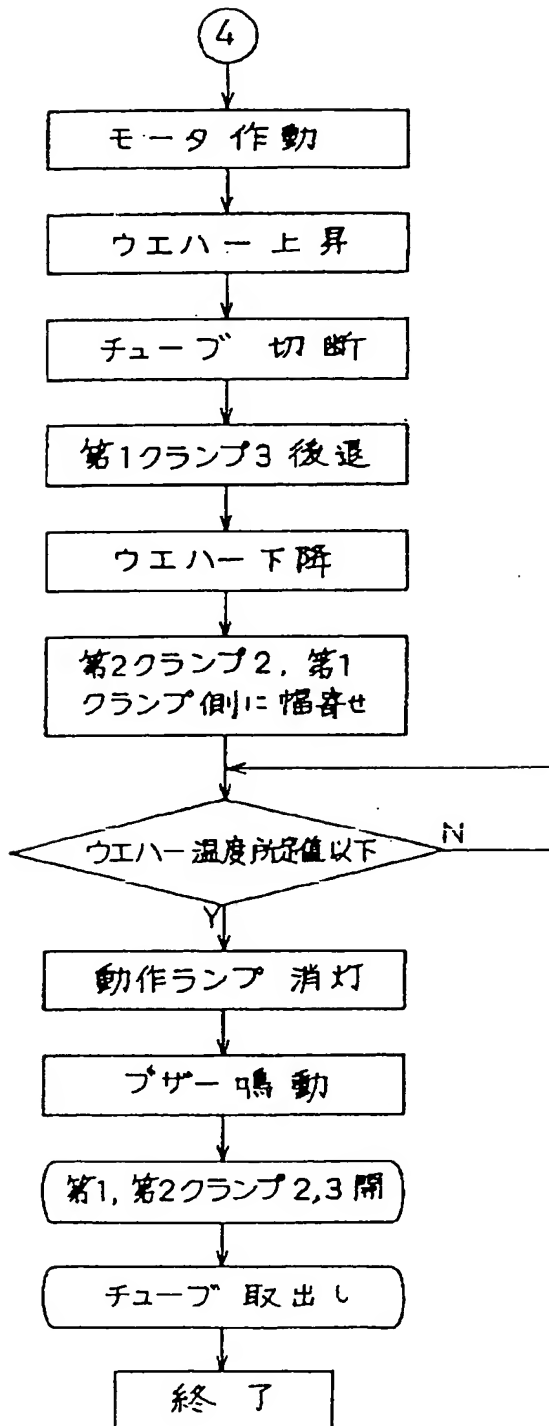
【図 11】



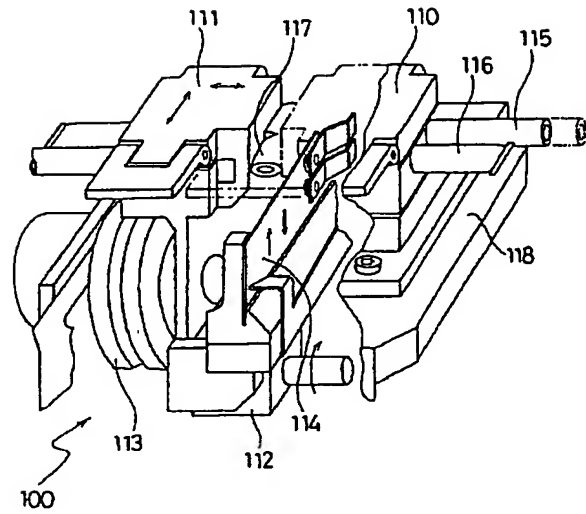
【図 12】



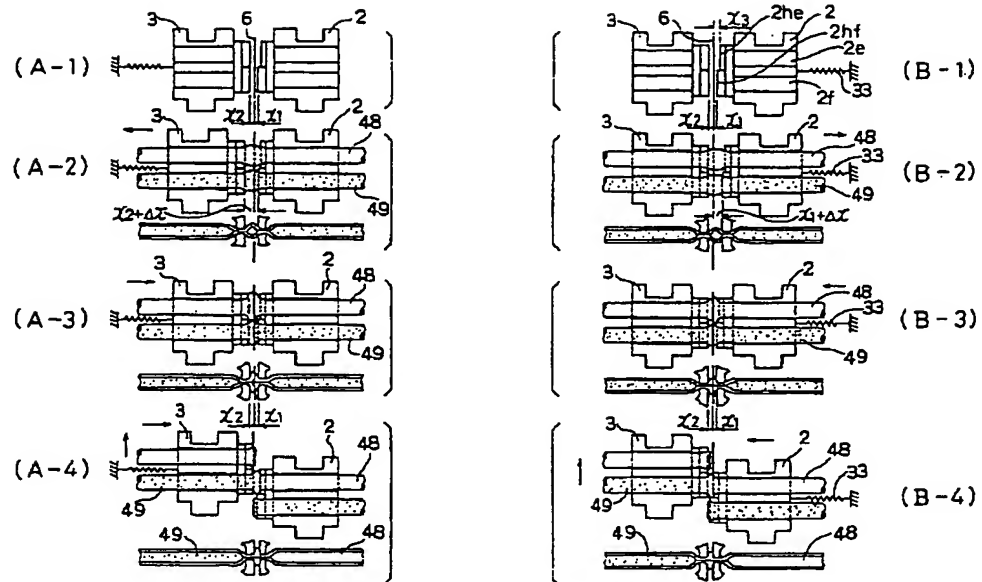
【図13】



【図19】



【図 18】



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